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EXPEDITION TO THE KARAKORAM AND CENTRAL ASIA, 1913–1914.*

By Cav. Dr. FILIPPO DE FILIPPI.

In the autumn of the year 1912 the plans of a scientific expedition to India and Central Asia were submitted by me to the Royal Geographical Society, with the object of obtaining their moral and financial support towards geophysical researches and the geographical exploration of a practically untraversed region of the Karakoram.

The contributions of this Society and of various other scientific bodies, including the Royal Society and the more important Italian institutions, added to the generous support of H.M. the King of Italy and of private individuals, made it possible for me to complete, within the course of a few months, the preparations necessary to this undertaking. To the Government of Italy I am indebted for the loan of nearly the whole outfit of scientific instruments; and to the Government of India for a liberal contribution, and also for the co-operation of the various Indian technical departments and of the Kashmir Durbar. In addition to this generous assistance, Major H. Wood, R.E., of the Trigonometrical Survey, S.A.S. Jamna Pershad, and the Surveyor Shiv Lal were deputed to take part in the survey work.

Included in our programme, and forming one of its most important items, was the establishment of a series of geophysical stations for observations of gravity and magnetism, to stretch in an unbroken chain across the vast and mountainous zone which separates India from Central Asia, and to be carried on through Chinese Turkestan as far as Russian Turkestan, thus uniting in one comprehensive system two pre-existing sets of gravimetric stations, namely, that of the Indian pre-Himalayan plains carried

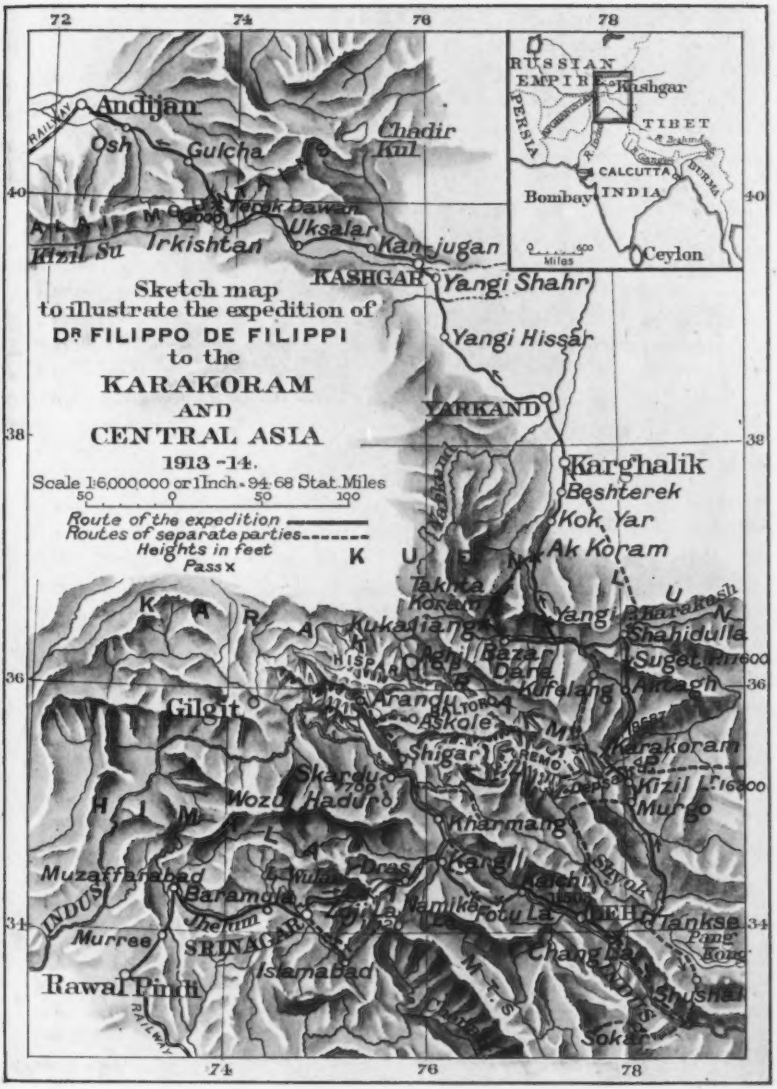
* Royal Geographical Society, June 14, 1915.

out by the Trigonometrical Survey of Dehra Dun, and that of Russian Turkestan and the adjoining regions. These geophysical observations were entrusted to Commander A. Alessio, second in command of the Expedition, and to Professor G. Abetti, of the University of Rome.

In addition to the pendulum and magnetic observations, our programme included meteorological and aerological investigations, and also measurements of solar radiation, all of which studies were undertaken by Professor C. Alessandri and Marchese N. Venturi-Ginori, and were to be carried out more especially at Skardu in Baltistan during the winter, and on the high plateau of the Depsang during the following summer:—that is to say, simultaneously with the geographical exploration of the eastern extremity of the Karakoram.

The exploration of the Karakoram, with its immense glaciers, was initiated by Colonel Godwin Austen in 1861–62, and since that date had been continued successively by Sir Francis Younghusband, Sir Martin Conway, Dr. and Mrs. Workman, the members of the Eckenstein-Guillarmod Expedition, H.R.H. the Duke of the Abruzzi, and Dr. Longstaff. None of these travellers, however, had penetrated further eastwards than the Siachen Glacier (77° long. E. Greenwich), and the map of that district was founded on sketches made in 1864–66 by the Surveyor Johnson, which show a group of glaciers at the source of the river Shyok in this region. These glaciers are marked as being of moderate dimensions and as not flowing beyond the confines of the valleys where they originate. Dr. Longstaff, on his return from exploring the Siachen in 1909, had followed the Shyok as far as its source, and was the first to grasp the probable size and importance of these glaciers. It was largely owing to his advice that I undertook the present exploration, and I may add that our discoveries in connection with these glaciers have more than justified his prophecies.

As regards the apportioning of our work, Commander Alessio, Major Wood, Professor Abetti and Mr. Spranger, with the assistance of Jamna Pershad and Shiv Lal, undertook the whole of the survey work. In connection with geodetic investigations I must mention the determinations of longitude by means of wireless time-signals according to a preconcerted plan. These signals were transmitted by the wireless station at Lahore and simultaneously received at Dehra Dun and by the expedition (Commander Alessio and Professor Abetti). The geological studies were entrusted to Professors Marinelli and Dainelli, and were to be continued over the whole route instead of being confined to the unexplored region of our itinerary. To Professor Dainelli fell the additional task of collecting the data for an anthropological and anthropogeographical study of the peoples inhabiting the regions traversed by the expedition, while Captain Antilli became responsible for the photographic, telephotographic, and cinematographic records. This programme, which many considered to be too ambitious and comprehensive, was carried through with complete success in seventeen months. The well-known guide Joseph Petigax, of


Sketch map
to illustrate the expedition of
DR FILIPPO DE FILIPPI
to the
KARAKORAM
AND
CENTRAL ASIA
1913-14.
Scale 1:6,000,000 or 1 Inch = 94.68 Stat. Miles
50 0 50 100
Route of the expedition
Routes of separate parties
Heights in feet
Pass x
RUSSIAN EMPIRE
PERSIA
TIBET
CALCUTTA
INDIA
BURMA
Bombay
Ceylon
Kashgar
Miles
Andijan
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Gulcha
Chadir Kul
Irkishtan
Uksalar
Kanjugan
Idzil Su
KASHGAR
Yangi Shahr
Yangi Hissar
YARKAND
Karghalik
Beshterek
Kok Yar
Ak Koram
Takmta Koram
Yangi Shahr
Shahidulla
Suget
Kukaliang
Kufelang
Gilgit
Askole
Shigar
Karakoram
Kizil L.
Skardu
Wozu Hadur
Kharmang
Murgo
Muzaffarabad
Baramola
Jhelum
Murree
SRINAGAR
Rawal Pindi
Istamabad
Namike
Otu La
Tankse
Changlat
Shushal
Sokar
INDUS
RAILWAY
74
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Commayeur, was engaged to accompany the expedition. Major Wood, Professor Marinelli, and Mr. Spranger joined the expedition in the spring of 1914.

The first group of members sailed from Europe early in August, 1913. Comparative pendulum observations had been taken at the Royal Hydrographical Institute at Genoa, which became the reference station for all our gravimetrical measures; and immediately upon our arrival in India Alessio and Abetti set up a station at Dehra Dun, where they also made their first experiments of wireless transmissions of time signals with Delhi, Simla, and Lahore, using the wireless receiving station of the expedition. On September 8 we were all assembled at Srinagar, Kashmir, which became our second geophysical station; and here Dainelli made several geological excursions.

For our winter headquarters we had chosen Skardu, the capital of Baltistan, and on September 15 we started out on the first stage of our long caravan journey, which was to take us through the deep valleys, over the mountain ranges and high plateaux of Baltistan and Ladakh, and across Chinese-Turkestan as far as the Russian Transcaspian railway of Andijan.

Included in our scientific equipment was a wireless receiving station; gravimetric, astronomical, and meteorological apparatus; several pyrheliometers for measuring solar radiation; all the necessary outfit for sending off pilot balloons, including sixteen steel hydrogen-cylinders; also chronometers, photographic apparatus, geodetic and survey instruments, to which must be added a whole encampment of tents to serve as laboratories and to shelter the members of the expedition, servants, coolies, etc., in all a hundred and fifty persons, with their luggage, kitchens, general camp furniture, etc. Yet these impedimenta, considerable as they may sound, were a mere trifle in comparison with the large stores of provisions necessary for the maintenance of men and beasts during our many months' wandering over the Karakoram deserts. This extremely cumbersome but indispensable baggage was packed on the shoulders of hundreds of coolies, carried on the backs of camels, of Zanskar and Nubra ponies, of sturdy plodding yaks, or piled high on the primitive waggons of Central Asia. This journey was to last for more than a year, and was to stretch over nearly 1000 miles, not including the large areas we covered during our many and long excursions outside of our itinerary, and during our exploration of an entirely new and untraversed region.

I will spare you a description of the well-known road between Srinagar and Skardu. Suffice it to say that we crossed the Himalaya without incident by the pass of Zoji La (11,120 feet = 3392 metres); after which we found it necessary to call a halt of ten days in order to set up a geophysical station at Dras (10,020 feet = 3054 metres), where a picturesque ruin commemorates the Sikh conquest of Baltistan, about the middle of last century. Another station was set up at Tolti, a small oasis on the right bank of the Indus. On October 25 we emerged from the last

defile of the Indus into a sandy and gravel-covered plain formed like an oval basin and crossed in its greater diameter by the Indus, which flows sluggishly along a winding bed dug through the alluvial strata. This great plateau, in the centre of which lies the village of Skardu (7700 feet = 2347 metres), is encircled by a crown of magnificent peaks which seem to close it in on every side, except towards the valley of the Shigar, which also is large, smooth, and sandy, and is so constructed as to form a northern continuation of the Skardu basin. The oasis of Skardu lies at the foot of a rocky hill, whose eastern ridge is broken by a terrace above which rises an imposing fortress, the solitary memorial of the days when Skardu was under the rule of independent rajahs. This was to be our headquarters for the next three and a half months, and here we established ourselves in two small bungalows, while the surrounding huts were fitted up as laboratories and storerooms.

After a successful preliminary experiment at receiving wireless time-signals from Lahore, Alessio, Abetti, Antilli, and Ginori, accompanied by Petigax, set out at the beginning of November to ascend the valley which leads south of Skardu to the Burgi La up to Wozul Hudur, a small terrace over 14,000 feet (4300 metres) high. Here, in spite of the deep snow and the severity of the weather, they succeeded in making magnetic and gravimetric observations and in taking measurements of solar radiation, associated with the launching of pilot balloons. They also climbed a peak (16,000 feet = 5060 metres) to the east of the Burgi La, where Antilli took some telephotographic views of the distant ranges of the Karakoram. After these successful experiments they returned to Skardu, where they made various geophysical investigations and two series of radiotelegraphic experiments.

During the whole month of November the weather was clear and peaceful, with autumnal lights and exquisite calm sunsets, reflecting a variety of the most delicate tints on the surrounding snow-covered peaks. Early in December came a few light snowfalls, but the clouds soon drifted away, and the new year was ushered in by a spell of magnificent days, when the temperature fell to zero Fahr. The heaviest snowfalls occurred in January; the snow-line, which on our arrival at Skardu was about 3000 feet above the valley, soon descended to the level of the plain, and the whole landscape became transformed into a vast expanse of whiteness. The clouds and the mists which enveloped the crests and peaks became a serious obstacle to the carrying out of our photographic and topographic work and to the observations of solar radiation.

Dainelli, after making some interesting geological investigations in the valleys of the Sind, Dras, and Indus, had worked through the whole of November in the basin of Skardu. In December he had ascended the valley of Shigar, and also those of the Braldoh and the Basha, the two branch valleys from which the Shigar springs, investigating snouts of the three largest glaciers of the Karakoram, the Biafo, the Baltoro, and the Chogo

UPPER SHYOK VALLEY.

UPPER INDUS VALLEY, FEBRUARY, 1914.

Lungma. Finally, in January he set off on a long excursion up the valley of the Shyok, starting from the point at which it joins the Indus, and continuing as far as the village of Biandong (Ladakh). He also traced back the rivers Saltoro and Kondus as far as their glaciers. During these geological explorations he was able to make some very interesting anthropological studies, besides noting and comparing the various social and economic conditions prevailing in the districts through which he passed. These excursions, carried through with complete success, prove that it is possible to penetrate without any serious difficulty, and during the depth of winter, into the most outlandish valleys of Baltistan, carrying an equipment so light as to exclude any supplies beyond the mere necessaries for life.

On February 14 we received the last wireless signals of the Skardu series; and on the morning of the 16th we took the road across Baltistan in the direction of Leh, which is situated in the valley of the Indus at an altitude of 11,503 feet (3506 metres), nearly 3000 feet higher than Skardu. Proceeding up the Indus valley we followed the river as far as its junction with the Suru Dras, passing over the same country which we had traversed some four months previously. During this interval between summer and winter the scene had assumed an entirely new character. Thick layers of snow covered the deeply cut valley, rounding off the jagged edges of the precipices and toning down the forbidding aspect of the landscape.

A four days' march above Skardu—at Kharmang, an oasis which lies at the foot of an imposing castle—we found the Indus frozen from bank to bank, which made it possible for people and ponies to cross safely. As we advanced higher up the valley it became more and more common for us to meet with these convenient natural bridges, which serve to connect villages and districts at other seasons completely isolated. Very rarely did we find the Indus sufficiently narrow to allow of its being spanned by the picturesque rope-bridges so characteristic of Baltistan.

Above the confluence of the Suru the Indus valley narrows into a gorge, and the caravan road leaves the valley to make a large circuit among the mountains. Dainelli, availing himself of the exceptional opportunities afforded by the frozen river, set forth to inspect this part of the valley, which hitherto had rarely—if ever—been visited by travellers. On this excursion he collected some valuable anthropological and social data regarding certain groups of the Dard race who have preserved their ethnical characters with unusual purity. Leaving Dainelli to his particular studies the remainder of the party started up the caravan road.

On February 22 we took up our quarters at Kargil, a little commercial centre situated in a large basin on the road connecting Kashmir with Tibet and Central Asia. This was one of the stations at which had been accumulating the large quantities of foodstuffs necessary for the maintenance of coolies and horses during our journey from Leh onwards. To obtain a sufficient quantity of provisions—in all forty-six tons of wheat and

barley, not to mention the large supplies of rice, tea, butter, tobacco, and similar commodities—it had been necessary to tap the supplies of the whole of Baltistan and Ladakh. Altogether one thousand sacks, containing nearly thirty tons of provisions, were awaiting us at Kargil, ready for further transport. The caravan road to Leh crosses two mountain passes at an altitude of about 3000 feet, which at the end of February were naturally covered by a great depth of snow. Yet bearers, horses, and yaks, slipping and stumbling on the frozen road, and pushing through the banks of snow with patient insistence, succeeded in a little over two weeks in conveying this mass of provisions as far as Leh.

Meanwhile it had been necessary to split up the expedition into several groups. Alessio and Abetti were detained at Kargil and at Lamayuru to set up the gravimetric station, and only reached Leh on March 26, a few days after the arrival of Dainelli, Antilli and Ginori, who in the interval had made an interesting tour among the many beautiful castles and monasteries scattered over the less frequented corners of Ladakh. I myself was already established at Leh, having preceded the rest of the expedition by twenty days to organize the transport of provisions to the valley of the Shyok. This was by no means a simple undertaking. It was necessary for our considerable caravan to cross the Kilas range by the Chang La pass at the great altitude of 18,400 feet (5600 metres), and during this passage the proverbial endurance of even the Ladakh porters and beasts of burden was often put to the severest test. However, by sending ahead a large herd of unloaded yaks to tread a path through the snow, it was found possible, by the beginning of April, to transport over this frozen road nearly 3000 sacks, which were at once despatched by the Shyok valley towards the plateau of Depsang in the Karakoram. The success of the undertaking is entirely due to the devotion and competence of Rasual Galwan, our caravan leader, and the expedition's invaluable servant.

During our two and a half months' halt at Leh we enjoyed the shelter and the unaccustomed luxuries of a private house, Captain Gabriel, Joint Commissioner for Ladakh, having very kindly placed his residence at our disposal. We also remember with gratitude the hospitality of the Moravian Mission and the Leh officials, of whose kindness and courtesy we retain the happiest memories.

At the beginning of April, having completed the geophysical observations at Leh, Alessio, Abetti, Ginori, and the guide Petigax, carrying with them the whole of the scientific equipment, started out southwards with the intention of setting up a station at Moré, on the plateau of Rupshu. This expedition, which was outside our settled programme, was undertaken at the request of the Survey of India, who wished us to repeat the rather doubtful gravimetrical determinations taken in 1871 by Captain Basevi, one of their officials. However, contrary to the assurances of inhabitants who should have been familiar with the climatic conditions

of the country, the plateau was found to be covered with a deep layer of snow. Having conducted the party, not without difficulty, to the brow of the plateau 18,040 feet (5500 metres), Alessio found it impossible to transport the heavy equipment any further, so was forced most reluctantly to return to headquarters.

Dainelli, meanwhile, had followed up the valley of the Indus and had made an excursion on the Rupshu plateau in order to study its geological and morphological conditions, which are especially interesting, owing to the traces of glacial excavations and the presence of some typical closed basins containing brackish lakes. Having returned to the Indus, he crossed into the basin of the salt lake Pang Kong, where he made some interesting studies of the anthropological characters of the nomad shepherds called the Chang Pa. He then returned to Leh by way of the Chang La.

On the arrival at the end of April of the second group of members (consisting of Wood, Spranger, Marinelli, Alessandri, Jamna Pershad and Shiv Lal) our two geologists, Marinelli and Dainelli, made a further excursion into the basin of the Zanskar, a large tributary of the Indus. During this period we made a series of meteorological observations, including the launching of pilot balloons and studies in solar radiation.

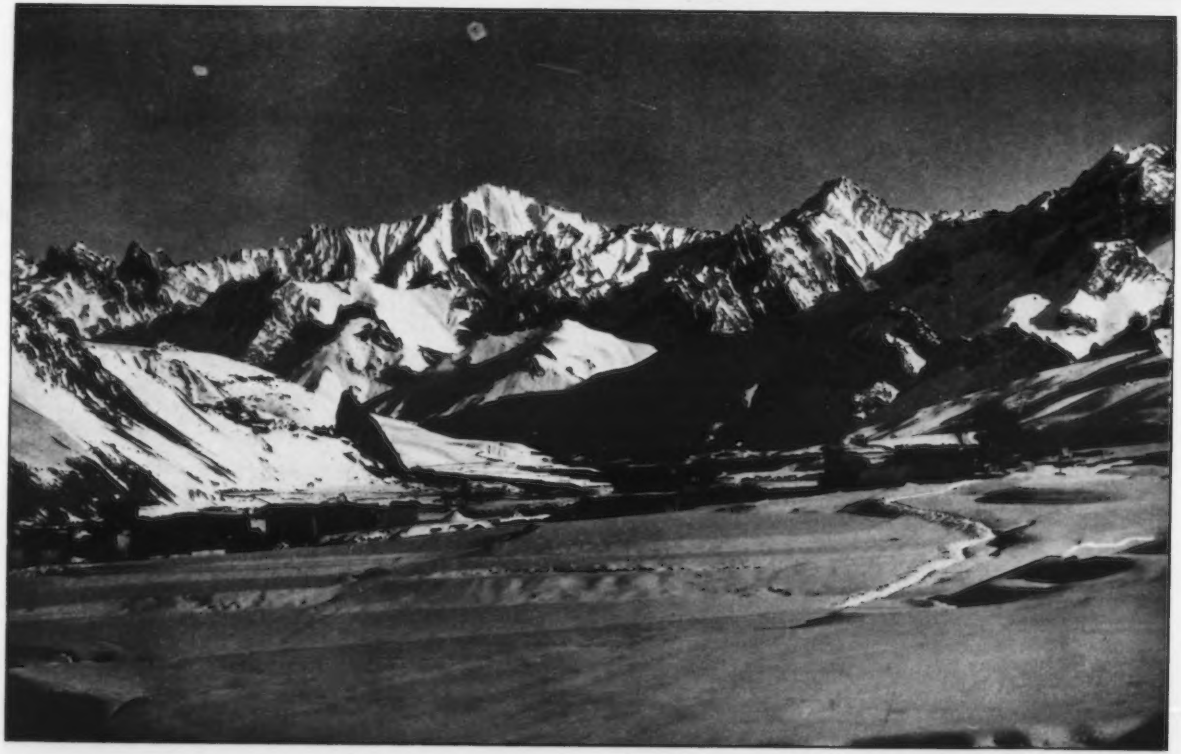
On May 15 we all took the road again, and three days later crossed the pass of the Chang La by the track which had previously been trodden hard by the hundreds of transport beasts; after which we descended in two marches to a little group of huts known as the village of Shyok. This was to be our last sight of human habitation till we arrived at the villages of Chinese Turkestan. The Shyok valley is deeply cut between the massifs of Chang-Cheen-Mo and Lingzi Thang, and rises gradually towards the Karakoram, the complicated watershed between India and Central Asia. The earliness of the season allowed us to follow the bed of the valley. Every now and then we forded the river, but were able to avoid the fatiguing ups and downs of the track which follows the left side of the valley. Our route lay across a rocky desert relieved by a very occasional patch of green, a sign of the welling forth of some mountain spring. Our transport beasts found little enough in the way of fresh pasture. Fed on dry provender, and suffering from mountain sickness, they became unfitted for the hardships of the journey. Fortunately we were able to replace them by horses and yaks drawn from other caravans which met us on their return journey from the Depsang, where they had deposited our provisions.

On May 30 we left behind us the valley of the Shyok, climbing some narrow gorges which are hemmed in by precipitous cliffs. Here we were obliged to wade for long stretches through the rushing and turbid waters which at this season of melting snow surged through the bed of the gorge. At length we emerged on to easier ground and joined the junction of the valleys which is known as Murgo. At this point the road which we had been following meets with the older track, only passable, however, in

the summer season, which leads from the Nubra valley and the Sassir pass. From thence onwards the aspect of the road grew more and more dismal. It was literally strewn with the remains of animals dead from exhaustion, mountain sickness, and starvation; carcasses of horses, asses, and camels in every stage of decomposition, from bodies surrounded by birds of prey to skeletons bleached white from long exposure.

Two marches above Murgo, and immediately under the brow of the high Depsang-plateau, we arrived at a spot called Kisil Langur (5000 metres = 16,300 feet). Here, deposited at the foot of a cliff, we were glad to find our store of provisions which, in accordance with our arrangements, had been accumulating there against our arrival. The Depsang plains were still in great part covered with snow, and the slopes and hollows so slushy and heavy as to make the choice of a camping-ground extremely difficult. However, nearly at the centre of the plateau, and in close proximity to its largest watercourse, we found a small terrace sufficiently dry for our purpose. This spot—17,400 feet above sea-level—was to serve as our headquarters and base of supplies until nearly the end of August. All around us, for a radius of 12 to 15 miles, stretched a vast and hillock-strewn plateau with shallow depressions inclining to the north-east, and merging to the east into alluvial plains which form part of the vague watershed between India and Turkestan. The edges of the plateau are uncertain and ill-defined, and shade off gradually into gentle slopes, except towards the south-west, where towers a majestic glacier-covered mountain which completely dominates the region. In the far distance, and on every side, rise a circle of lofty mountains, whose peaks just appear above the edge of the plateau. Those to the south and west are dazzlingly white from their covering of snow and glaciers, and are in startling contrast to those in the direction of Asia and Central Tibet, which have the forbidding appearance of bare rocks. The surface of the plateau is a mass of minute detritus, and is entirely devoid of vegetation, except for occasional patches of a yellowish-green plant which at first view suggests, more than anything else, some malignant disease of the soil. There can surely be few corners of the world which give such an impression of dreariness and utter desolation as this barren region of rocks and stones, which, moreover, during our entire sojourn was swept continuously by an icy wind and beaten upon by hail and sleet. The line of skeletons which marked the length of the caravan road across the plain are a fitting feature of this desolate country.

The transport of our provisions from Kisil Langur to the base of supplies, and from there to the forward depôts of the exploring parties, occupied my attention during the whole of June. Immediately on our arrival at the Depsang we had dismissed our horses, which could not have survived for any length of time at that altitude, so that the transport during the summer months was carried out by 130 Ladakh and Kargil porters. This was the maximum number available, and, moreover, it would have been difficult to have provided food for a greater number.



VALLEY OF KARBU (LADAKH), FEBRUARY, 1914.

CAMP ON THE DEPSANG PLATEAU.

On our arrival at the plateau we had immediately started the scientific work in its various branches, which included survey, geophysical and astronomical observations, transmission of wireless signals, the measuring of bases for topographical work and experiments with pilot-balloons, etc. In the bleak and exposed locality where we had pitched our camp, at an altitude of 17,400 feet, Alessandri and Ginori, for nearly two and a half months, often working day and night, collected meteorological data, carried out aerological investigations, and also took readings of solar radiation on the rare occasions when the atmosphere was sufficiently clear for that purpose. On June 11 Marinelli and Dainelli set forth on a geological expedition in the direction of the Tibetan plateaux, taking the route of the Chipchak and Karakash valleys. After crossing a mountain pass over 20,000 feet (6100 metres) high, they joined the closed basin of the Taldat which lies to the north of the Lingzi Thang plain. Later, independently of the rest of the expedition, they explored the upper basins of the Shyok, Remo, and Yarkand.

On July 1, after a preliminary reconnaissance, we set out to explore the Indo-Asiatic watershed to the east of the Siachen Glacier. Wood, Spranger, and Shiv Lal had undertaken to survey the region which lies between the Remo basin and the Karakoram Pass, while the rest of us made directly for the glacier itself. To this glacier we have left the name of Remo, mentioned in Johnson's sketches, though the meaning and derivation of the word remain an enigma, in spite of all my efforts to find traces of it in the local dialects. We descended the western slopes of the Depsang, and here we were glad to see signs of herbage—the meagre pasture of the Tibetan antelopes and gazelles, who graze peacefully on these mountains, far away from the haunts of man. Here and there grew a starved-looking plot of heather or a low bush of "burtsé"—most valuable of plants, affording as it does the only form of fuel available in these regions.

Proceeding on our way we gained the basin of the River Shyok near the point where it joins the Chipchak, thereby taking the most direct route to the Remo Glacier. The glacier is divided into two main branches of fairly equal dimensions, which descend in gentle slopes from their respective valleys to the north and west, and join almost at right angles. Their point of junction is sharply defined by a wide streak of moraine, which we fixed upon as being our best and shortest route across the front of the glacier. On July 2 we pitched our camp a few hundred yards away from this front, which stretches through the whole width of the valley, giving the impression of a great crest of foam. On a nearer view this snout proves to be bristling with needles, pinnacles, and pyramids of ice. From the base of the glacier issue forth several rapid streams which mingle together to form the origin of the River Shyok.

The difficulty of finding safe fords through these streams, and a heavy snowfall which continued without interruption for two days, detained us in this camp at the foot of the Remo. Finally, on July 7, we were able

to commence the work of climbing the glacier by way of the moraine, which was most irregular and obstacled. Our track was a succession of crests and hollows, tunnels and watercourses. The traverse, however, was achieved without any great difficulty, and soon we had joined the point where the glacier forks off towards the west and north.

We first explored the northern branch of the glacier towards the watershed, passing along first between the slope of the valley and the side of the glacier, and later along the marginal moraine. Near us, with a gentle slope, flowed the large ice-river. The surface is entirely formed of tall pinnacles and pyramids, which have nothing in common with the seracs of our Alps, being due to melting and erosion of running waters, and not to fractures. This valley is situated between mountain ranges of but moderate dimensions, very different in appearance from the gigantic battlements of the Baltoro Glacier. In place of the sombre and shut-in Baltoro with its dark mantle of stones, the Remo stretches out immaculately white and open, giving an impression of vastness out of proportion to its actual size. As we advanced higher up the surface became less and less broken, till at last, at 8 or 10 miles above the front, the former cracks and pyramids of ice were replaced by gentle transverse undulations. A little further on we came to a large basin which receives from the north a tributary glacier nearly as large as the chief branches of the Remo. From this point onwards the glacier changed its course and took a wide turn westwards.

We decided, before proceeding any further, to explore the tributary glacier, and here there was a surprise in store for us. It was not long before we realized that, a little above its junction with the main glacier, there flowed through a cleft in the mountain to the east a short and thick tongue, giving birth to a river which evidently did not belong to the basin of the Remo. Meanwhile, three days before us, Wood and his party had also arrived at this particular point. Through a saddle to the west of the Karakoram Pass they had penetrated into a large circus of confluent valleys which they identified as belonging to the basin of the Yarkand, one of the principal rivers of Central Asia. In following up the river they had arrived at this tributary glacier of the Remo, and thus had an excellent opportunity of connecting their survey with ours. We had thus not only discovered the source of the Yarkand, hitherto erroneously marked on nearly every map as rising near the Karakoram Pass, but we had also ascertained this remarkable fact—that it flows from the same glacier which gives rise to the River Shyok.

The small lake which S. W. Hayward in 1868 identified with the source of the Yarkand, was found to be 20 miles further up the valley, and to have practically no importance as regards the feeding of the river. Major Wood and his party had next travelled 60 miles down the valley, verifying the existence of two large tributaries which later on were to be the object of a separate exploration.

ICE-NEEDLES AND PYRAMIDS OF THE LOWER REMO GLACIER.

SOURCES OF THE RIVER YARKAND.

We climbed the northern tributary glacier to its summit, where we found a saddle at an altitude of 19,300 feet on the watershed, and then came back to the main branch of the Remo to complete its exploration.

To the west the mountains are covered with snow and glaciers, while the slopes to the east are rugged and bare. The surface of the glacier is intersected by streams and broken by innumerable pools of all shapes and sizes.

At an altitude of a little over 18,000 feet we reached the snow-level. Here the slope becomes much steeper as it leads to the upper circus, which is vast and even, and has the appearances of a plateau. The glacier fills it to the brim and overflows between low peaks which look like islands in a sea of ice. One of the saddles leads to the Siachen basin; another, to the north, marks the watershed. The whole glacier circus is intersected in every direction by treacherous crevasses concealed under a layer of snow which gives way beneath the tread. We realized this danger when one of our porters suddenly vanished from view. Luckily the crevasse in question was narrow and not very deep, so that he escaped with nothing more serious than a fright. From thence onwards we advanced with great caution and roped together.

There was no place for us to pitch the tents except in the snow. During the last four days of our ascent the weather had grown steadily worse, even to the point of hindering us in our exploration of the basin, which we were obliged to carry out in one sole excursion.

At the end of July we spent a few hours in the company of Marinelli and Dainelli, who for the last six weeks had been making explorations over the region to the west of the Depsang. On descending from the eastern plateau they had visited the front of three glaciers—the great and small Kumdan and the great Aktash—which flow into the valley of the Shyok near its source; after which they had taken the route up the right front of the Remo, and had climbed the glacier as far as its basin. After a brief halt at our camp on the Remo they proceeded towards the source of the Yarkand, in the direction of the valleys already explored by Wood and his party.

Altogether we remained for eleven days in the upper basin of the Remo, first nearly buried in snow at an altitude of over 19,000 feet (5800 metres), and later a trifle lower down the glacier, where we found a patch of stones to serve as a camping-ground. During the whole of this time we were inactive, kept prisoners by the severe weather. Day after day we strained our eyes to pierce the white mist which enveloped us like a cloud. The snow fell unceasingly, now gently and softly, as reluctant to break in on that stupendous silence, now caught up fiercely by the wind as if in angry protest against the invader. The cold was severe, and some of our coolies suffered badly. They passed their days shivering in their tents, which they had pitched as near as possible to ours for fear of crevasses. It was impossible to kindle a fire or to take two steps in the open without sinking

knee-deep in the snow. Though all of them felt the altitude, and many became frost-bitten or snow-blind, yet they remained perfectly disciplined, and not one of them was heard to utter a complaint. At length, having given up all hope of reaching the saddles on the edge of the circus, we began to think of our return journey, and the difficulty of transporting our heavy equipment through the increasing depth of snow.

On August 4, after folding with much toil the frozen tents, searching for the hammers, tools, and other objects, which in spite of every precaution had become buried in the snow, we struck camp and began to retrace our steps down the glacier.

Toiling heavily over the snow, groping our way through the mist, we pursued our slow and painful route, taking actually ten hours to march a distance which thirteen days earlier, before the snowstorms, we had covered easily in less than half that time. The coolies took from twelve to fifteen hours for that day's march; some only arrived at midnight, and one who got separated from his companions passed the whole night in the snow. Fortunately he was still alive when found next morning by our search party. It is quite evident that we could not have delayed our return journey any longer without serious risk to the caravan. The landscape had become almost unrecognizable from its deep covering of snow. Had we not completed the survey during our ascent we should never have been able to define the correct limits of the tributary glaciers. The mapping out of the southern branch of the Remo, made easier by our previous survey, was carried out during a two days' encampment at the edge of its upper basin, into which flow eight large tributaries, descending from high and distant saddles.

On August 13 the whole expedition was once more united at our Depsang headquarters, the different groups having each completed its particular work. The extraordinarily severe weather had not been confined to the Remo. There had been heavy snowfalls on the Depsang, the Karakoram Pass, and the adjoining valleys, with the result that the whole expedition had been hindered in its work. Even the caravan road between Central Asia and Ladakh had been for some days encumbered with snow, contrary to the records of every former traveller in those regions. It may therefore be assumed that the summer of 1914 was an exceptionally unlucky season. As we shall see later, it was to be followed by an equally severe autumn.

Our communications with Leh had been seriously interrupted on account of the floods and landslips, which had swept away part of the track. However, on August 16 came a bunch of horses carrying our mail bags, which had been accumulating for several weeks. Among the packets of letters and newspapers was a laconic wire from India announcing the outbreak of the European war. It would be impossible to describe the consternation caused by these tidings. Though neither England nor Italy was said to be involved in the struggle, yet the news came upon us as something

MIDDLE PORTION OF REMO GLACIER, NORTHERN BRANCH.

THE AGHIL RANGE FROM A SPUR OF THE UPPER YARKAND VALLEY.

infinitely tragic and ominous. In the face of this European outbreak our expedition seemed suddenly to dwindle to utter insignificance, like a wisp of straw about to be swept into a whirlwind.

When our first consternation had subsided we summoned a meeting to discuss our responsibilities in this difficult situation. We were due to set forth on our journey to Chinese Turkestan, and so for weeks, even months, might be cut off from all communication with the world. Under these circumstances Commander Alessio and Captain Antilli of the Italian Navy and Army, and Alessandri of the Reserve, decided to return at once to their country by the quickest and shortest route—namely, that of India. The departure of these members was a serious loss to our party, though fortunately Alessandri had already completed his meteorological work. Major Wood, through the liberality of the Survey of India, was preserved to the expedition, and succeeded Alessio as second in command. The geophysical work devolved upon Abetti and Ginori; and to Abetti fell also the photographic work for the remainder of the journey. In this manner we readjusted the distribution of work, and thus the expedition was able to accomplish its mission without reducing by a single item its settled programme.

On August 20 we started off from the Depsang with a caravan of sixty camels and fifty horses, which had come up from Suget Karaul, a small Chinese fort on the Indian frontier. On the morrow we crossed the Karakoram Pass, 18,600 feet (5800 metres), and entered a region of wide arid valleys with hardly a sign of vegetation. Whole days were to pass without our seeing even a blade of grass or a trace of moss or lichen. Even the weather seemed in sympathy with the prevailing dreariness. The icy-cold blizzards, the skies of leaden blackness, the mists which hung heavily over the mountains, all conspired to render our passage through this region as cheerless as can be imagined. The scenery might have outdone even the Depsang in desolation, had it not been for an occasional flame-coloured rock standing in bold relief against the surrounding drab-coloured hills.

Here we split into two parties. Spranger with Petigax and the two surveyors continued down as far as Kufelang in the Yarkand valley, while the rest of us crossed the Suget Pass, 17,600 feet (5400 metres), to Suget Karaul in the Karakash Valley, where our numbers were further reduced by the departure of Marinelli and Dainelli, who started for Italy by way of Kashgar and Russian Turkestan. At Suget Karaul we halted eleven days for the setting up of the customary geophysical station.

Leaving the encampment on September 4 we crossed a pass 16,000 feet (5000 metres) high and descended to Kirghiz Jangal in the Yarkand Valley, carrying sufficient food for a few weeks' journey and only our topographical instruments, the remainder of our equipment being sent to Yarkand by caravan. Notwithstanding the lateness of the season we were determined to make an attempt at exploring the Oprang Valley. So far as I know, Sir F. Younghusband is the only European who has set foot in

it. Ginori, Abetti, and myself, with Janna Pershad, started downstream from Kirghiz Jangal with the intention of reaching the Oprang Valley by crossing the Afghil Pass. Meanwhile Wood proceeded up the valley to join Spranger at Kufelang, and to explore with his assistance the two western tributaries of the Yarkand, which they had noted a month earlier. These two large rivers do not flow from the northern slopes of the Karakoram, but from a snow-bound chain which in all likelihood divides the basin of the upper Yarkand from that of the Oprang.

As regards our exploration of the Oprang Valley, we proceeded for five days down the Yarkand, a large turbid river, which is continuously altering its bed by fretting away its banks of gravel and sand. Our progress was slow and obstructed. During the first two days of our journey we were obliged to ford the Yarkand no fewer than eight times, and this was only possible at those points where the force of the current was lessened, either by the river widening out or by its forking off into several branches. Further down the track the valley closes into a long deep gorge, which forced us to keep to the higher ground. In places the path was so steep and precipitous that our porters were often obliged to unload the beasts and carry their packs for several hundred yards at a time. At Bazar Dara, where the Yarkand receives a northern tributary, we were forced to abandon our pack-horses, and to push on with only our saddle-horses and the sure-footed yaks.

From one of the spurs which obstructed our path we had looked forward to enjoying a magnificent panorama of the Aghil, but unfortunately heavy clouds completely enveloped the mountain crests. We could only see the glacier-covered buttresses stretching down to where, more than 3000 feet beneath us, flowed the River Yarkand, swirling and boiling between cliffs of shiny black schist. After a precipitous descent we reached the river-bank opposite to the valley by which we were to climb the Aghil Pass.

To arrive at the opposite bank was a more serious problem. After various vain attempts two of our strongest saddle-horses, with their intrepid Kirghiz riders, succeeded in swimming the river. On the further shore they found five camels which had been turned out to summer pasture. In order to see to what extent these animals would resist the current our horsemen drove them into the water, and the fact that these unloaded beasts were rapidly swept downstream convinced us that it would be impossible for our caravan to cross the river in its present condition. As the weather was consistently rainy there seemed no hope of the current abating. Moreover, even had it been possible to penetrate into the Oprang Valley, it is very doubtful whether, at that late season, we could have made a satisfactory exploration of its glaciers. As far as we could judge from our distant view of the Aghil Mountains, the range is of such dimensions that to explore it adequately it would be necessary to devote a whole season to that project alone.

Having with much reluctance abandoned this excursion, we continued

our journey to Central Asia, taking the more western of the two short cuts which lead to Yarkand city, while Wood's party proceeded, according to our agreement, along the second road which crosses the Yanghi Dawan pass. Our route lay across four mountain passes from 10,000 to 17,000 feet high, and was often of breakneck steepness. The track wound in and out of gorges full of loose boulders, through swirling torrents and down detritus-covered slopes, making very difficult going for our horses. The poor beasts slid and stumbled along, jumping painfully from rock to rock, and at the end of a day's march were usually utterly exhausted and bespattered with blood and foam.

But our travels in these steep and barren regions had already drawn near to their close. Little by little we began to see signs of permanent habitation, occasionally a patch of cultivated ground, and actually green bushes and trees. Finally, we turned our backs on the mountains where we had worked and wandered for so many months, and emerged into a line of oases and villages, which divides the mountains from the plains of Central Asia. We next pushed on across Chinese Turkestan, only halting thirteen days at Yarkand to take the usual geophysical observations. On October 15 we arrived at Kashgar, where we were received with hospitality by the British and Russian Consuls-General. Here, a few days after our arrival, we were joined by Wood, Spranger, and Petigax. Here also we took leave of our indefatigable workers, Jamna Pershad and Shiv Lal, who in less than five months had mapped out a territory of about 5000 square miles, working often under most trying conditions.

On October 27 we left Kashgar to cross the last belt of mountains between Chinese and Russian Turkestan. The passes were already deeply covered with snow, especially the Terek Dawan, 13,000 feet (4050 metres). However, in ten days we succeeded in covering more than 200 miles of road, and on November 7 we reached the railway at Andijan.

Two days later we arrived at Tashkent, where Abetti made a last series of observations, which definitely connected the Indian system of gravity stations with that of Asiatic Russia. Our work was completed. Before publishing any adequate reports it will be necessary to study the data we have collected.

Note.—In the above paper I have attempted only a superficial sketch of the territories crossed by the expedition. For a systematic account of our work, I would refer the reader to the reports published from time to time in the *Journal*. The map of the districts surveyed is in course of construction, and will be published shortly.—F. D. F.

The President (before the paper): We have to-night a double reason for welcoming our guest, Dr. De Filippi. We are always delighted to see and to listen to a traveller who has won one of our Gold Medals. Dr. De Filippi has crowned his many feats in mountain exploration by carrying through one of the

most completely organized expeditions that has ever entered the Himalaya. It was no mere climbing party, but an expedition completely furnished both as regards its composition and equipment for investigating the various problems raised in the scientific exploration of mountains. It comprised two geologists, two meteorologists, an anthropologist, two geophysicists, two topographers, surveyors, and an Alpine guide. Major Wood, of the Survey of India, was attached to it, and it had the hearty support both of the Italian Government and of our Indian Government, who both contributed substantially to the expenses. We welcome most cordially this and other indications that the official ban laid of late years on exploration in Central Asia will not be maintained in the future.

But we have another reason for giving to Dr. De Filippi at this moment a special welcome. He was, as you know, to have read us his paper in April, but in the crisis of his country's fortune he felt himself unable to leave Italy. As a qualified medical man he had volunteered for important service in the Italian Red Cross. Now, however, the great decision having been reached, he has, by an act of courtesy on the part of the Italian authorities, been granted leave to come to us. It is an act of courtesy which the Society must warmly appreciate, and for which we would gladly make any return in our power. I am sure you will wish me at least to beg Dr. De Filippi to carry back to Italy not only our thanks to those who have put no difficulty in the way of his coming over here, but also our most affectionate and cordial greetings to all his fellow-countrymen. Englishmen—educated Englishmen—have a feeling for Italy which might well be described by a stronger word than "affection." And it is with something more than self-interested pleasure that we have welcomed the entry of Italy at our side in this great world-war. We value at its full worth her material support; we look forward with confidence to the prowess of her gallant fleet and army. But she brings something that is of even more value than material aid, something that is an unknown quantity to our common foe. That something is moral judgment and spiritual force. Italy has proved her soul. With many inducements to traffic with unrighteousness she has preferred to [illegible] the chances of war with a ruthless enemy, the lives of her sons, and the priceless treasures of her cities, in the cause of Law, of Liberty, and of Humanity. In the crisis of the world's history she has shown not only the enthusiasm that made United Italy, but also a dignity worthy of ancient Rome, whose traditions she inherits. From the steps of the Capitol her statesmen have denounced and laid bare the schemes and plottings of the evildoers who have bathed Europe in blood. In the streets of her cities, of Milan, Genoa, and Venice, her people have cried for judgment on the murderers of the *Lusitania*.

Let us wish all good fortune to Italy's soldiers and their gallant King. Forty years ago I incurred the wrath of certain German writers by describing the mountains of the Trentino as "Italian Alps." May this summer see my forecast verified. God save Italy.

Dr. De Filippi: I have always felt myself greatly privileged when I have been called upon to address an English audience, but more than ever on this present occasion, when our countries have been drawn into still closer sympathy, and have reunited against a common foe in the cause of the higher ideals of humanity.

I have listened with joy and pride to the kind appreciative terms with which you spoke of my country. I wish that some one of more consequence than myself were here to-night to answer you. I am not a politician, and I can only state that all Italy has hailed with immense joy and enthusiasm the decision of her King and her Government to join the mighty struggle for civilization and for the liberty of the peoples. This is the first time in history that we fight beside your glorious country. May the events prove to you that we have not forgotten our debt of

gratitude for the generous help and encouragement held out to us by England during our war of liberation.

I must add that it was with the greatest pleasure and satisfaction that I found myself able to come in person to thank the Society for the distinction they have conferred upon me, and through me on the whole expedition. No one could be more alive than myself to the high honour I have received in being made a Gold Medallist of the foremost Geographical Society in the world.

I thank you, Mr. President, and members of the Council, most sincerely and warmly on my own behalf and also on behalf of my companions, to whose unfailing loyalty and devotion the success of the expedition is chiefly due.

(*Dr. de Filippi then read the paper printed above, illustrated with a very fine set of photographs, after which a discussion followed.*)

Sir Francis Younghusband: It has been a very great pleasure to me to welcome Dr. De Filippi here this evening, because we are friends of many years' standing, and because the region in which he has been carrying out his important scientific investigations and very interesting exploration is one in which I have myself been personally interested for a great number of years. I also specially welcome Major Wood here this evening, for I have not met him since we last parted in the heart of Tibet. Dr. De Filippi said that the Dipsang plains were, he must conjecture, one of the most desolate regions in any quarter of the world. I can entirely corroborate that impression. I have twice crossed those plains, and I have been in a good many other pretty desolate regions of the world, and as he described them I conjured up to myself the scenes I had witnessed, and especially a view of the Gobi Desert in Central Asia, which I crossed in 1887, and which my predecessor there, the great Russian traveller Prjevalsky, had described as so desolate that the deserts of Tibet would be considered fruitful in comparison. I thought of that scene and the scene on the Dipsang plains, and I came to the conclusion that the palm should go to those Dipsang plains. I do not know what it is about them. It is not merely the absence of vegetation, because one has seen that in Tibet, in the Gobi Desert, as well as in other parts of the world; but I think it is the height—the fact that any one travelling there is travelling at a height of nearly 18,000 feet, and is consequently in a state of most terrible exhaustion. It is that and the fact that the whole plain is strewn with the bodies and skeletons of these many hundreds of poor animals who have succumbed on the way.

The most interesting purely geographical statement which Dr. De Filippi made this evening was his account of the discovery of the source of the Yarkand River, and the remarkably interesting point that the same glacier which gives rise to the Yarkand River also gives birth to the Shyok River, the great tributary of the Indus. The Yarkand River is the principal river of Chinese Turkestan. I could not say what its exact length is, but it must be well over a thousand miles, and Dr. De Filippi has discovered its source in this Remo glacier, which at the same time gives birth to the Shyok River, so that while some of the water of this glacier goes off into Central Asia and buries itself eventually in the great desert of Gobi, the rest goes off south into the Indus and the Indian Ocean. Thus one and the same glacier gives birth to two great rivers, with destinations so far apart. That is a point of great geographical importance, upon the discovery of which this Society should most sincerely congratulate Dr. De Filippi. Another Gold Medallist of our Society, Hayward, had thought he had discovered the source of the Yarkand River in 1868, but exploration in those days was carried on in very adverse circumstances. Hayward and an uncle of mine, Robert Shaw, who was also a Gold Medallist of the Society, were the first Englishmen to penetrate the Himalayas of Chinese Turkestan. They were together on those plains, and were arrested by the

Yarkandis and kept under guard, but Hayward managed to elude his guards and made a dart off in the direction of the Yarkand River. After a rapid survey he thought he had discovered its source, but, as Dr. De Filippi has now established, he was in error.

Dr. De Filippi said that he thought I was the only European who had visited another great river of those parts, a tributary of the Yarkand River, the Oprang River. I did have the interesting experience of actually discovering the Oprang River in 1887 on my way from Peking, and I visited it again in 1889, but I am not the only European who has visited it, for in 1889 I came across the Russian traveller Grombtchevsky, who also made an exploration of the river, and Lieut. Cockerell and other officers have visited it in its lower reaches. But the source of the Oprang River and its upper basin still remain to be explored, and it is one of the most interesting fields of exploration still remaining in the Himalayas. I hope that when this war is over some of the officers in India may direct their attention to that region, and that whoever undertakes that interesting enterprise may be animated by the same enthusiasm, may exercise the same foresight and careful attention to detail, and may possess the same capacity for organization and for leadership which has been so eminently displayed by Dr. De Filippi in the conduct of the exploration of which he has given us an account this evening. Such an exploration, so carried out, is the envy of us who have gone before, and it should be an example for all who follow; and as a fellow-explorer I desire to tend to Dr. De Filippi my most sincere congratulations upon his splendid achievement.

The PRESIDENT: We have in this Society many travellers who could talk upon this region; some of these are not present to-night. Dr. Longstaff is serving in India, Dr. and Mrs. Workman, I believe, are not now in London. However, we have Colonel Godwin-Austen, who is the father of exploration in this region; Sir Martin Conway, and others. I will call first on Colonel Godwin-Austen.

Colonel GODWIN-AUSTEN: It has been a very great pleasure to me to be present and to hear Dr. De Filippi describe his last expedition to the Himalayas. It is a great many years since I was in that part of the world surveying under Captain Montgommerie, but it is a great satisfaction to me to find that the work which was begun by Everest and Waugh, Walker and Montgomerie, is still being carried on so ably by the officers of the Survey at the present time, and that the results of the geodetic labours of the officers of the past are leading to the more scientific expeditions that are being carried on now. The portion Dr. De Filippi described, the sources of the Shyok Valley, I never have been in myself. After surveying the Baltoro side, I was deputed to survey the Chang Chingmo, which is a large area of country just to the eastward. On the western margin of that work I can remember a marvellous view, vast in its extent, I had from a peak about 19,000 feet which overlooked the Shyok Valley, and from which I saw the great bend in the Shayok (lat. 34°), and far away to the north-west the great mass of snowy peaks rising to 24,000–25,000 feet. It is a great gratification to find that the so-called Remo Glacier is now surveyed. It is impossible to say where the name came from. Johnston had a curious way of naming peaks; sometimes he would name one after the man who went up and put a pole upon it, so that the name Remo may be the name of a man in his party who came back after visiting the glacier. I was rather surprised the first time I found a peak on my plane-table which had been named in this way. It must not be forgotten that Mr. Ryall and Mr. Johnston, although both very able surveyors, when they were in that ground had never seen such glaciers before, and I think they were perfectly staggered by the character of the country. They had not the means nor party strong enough to go into it, and their sketching of that piece of ground was very rough reconnaissance and slight indeed

Nothing was shown except the lines of main drainage. I remember when Johnston came back from his expedition to Khoten, Colonel Walker asked me to extract from him such information as was possible, and I found he, having no previous knowledge of a past glaciated country and glaciers, could not describe what he had seen. There is very much that is gratifying with regard to Dr. De Filippi's expedition, particularly, I think, that Italian officers have joined with officers of the Indian Survey in carrying out work of this kind. It is something to be proud of that we should thus be joined by able scientific men and officers of the Italian army, and I think everybody will join with me that we hope in the future that this unity of work will be continued.

Dr. Arthur Neve: At this late hour I will only say one word, and that is in defence of the unfortunate name Remo which is now thrown into the melting-pot. The natives of the country well know it by that name, and I think we may be sure that Johnston got it in the first instance from them. I know that when I was in that neighbourhood a native pointed to the Remo glacier, and he said, "That is the Remo glacier;" so they did know something about it in the olden days before our map-makers got to work.

Sir Thomas Holdich: I have only a word or two to say. I think that in order to appreciate the magnificent work which has been done by Dr. De Filippi we should understand what an enormous opportunity for exploration there is in that tremendous band of mountains which frames in India to the north. For 3000 miles that mountain barrier extends from Burma to Persia. In the first section of it, that which we geographically call the Himalayas, we know nothing except the extreme ends of it. We know where the Brahmaputra parts the hills in the east; we know something about the north-west of it, but of the vast territory of Nepal we know nothing at all. In the centre section of this huge barrier, in the country where Dr. De Filippi has been, and where he has taken us to-night, you have been able to see for yourselves something of the nature of the country and to estimate its opportunities. Those amongst you who are Alpine climbers will understand the enormous conformations of Nature in that part of the world, if I say that you might take the whole of the Alps between the Rhine and the Rhone, and you might dump them down in one of those huge valleys of the Himalayas, and it would hardly affect the landscape. From there, again, the barrier passes on through the giant Mustagh or Karakoram range (dominated by that great peak to which Colonel Godwin-Austen's name is given), through the Hindu-Kush to the Persian frontier. All this country has been brought into the general scheme of scientific geography by the work of the Indian Survey. We cannot call it unknown, because there are innumerable peaks and points fixed about it which form the basis of all future exploration; but still no Indian department is so constituted as to be able to support what you may call an academic study of science over any countries which are so absolutely unprofitable as those wild mountains of which we have heard and seen something to-night. But still, unproductive though they may be, we cannot call them unimportant. It is important that we should know about them, for there is our frontier—that is, the frontier of India, the barrier against all the rest of Asia; and it is a marvellous thing that through Burma, through the whole range of the Himalayas, there should exist such a frontier and barrier of such magnificence as that of the snowy range, perfectly impenetrable, mostly uncrossed by human foot, and one which will stand at all times as a sure defence of India on the north. We may still say the same of it where the frontier leaves the Himalayas and takes to the Karakoram and Mustagh ranges. So that for the extraordinary distance of 3000 miles we have a perfectly impenetrable and effective barrier against northern aggression until we come to the extreme end of it. There, perhaps, for the narrow

space of 200 miles or so, we have an open gateway from the north, and there only. It is to me a wonderful thing that we who live in a narrow sea-girt island like this should have planted ourselves in two great countries, and taken up the protectorate of those countries, countries like Egypt and India, and find in both of them that the frontiers and barriers have been so disposed by nature that we can leave them almost to take care of themselves. We take no trouble about our frontiers. Other countries have to look after theirs very closely. But we must remember that there is that one narrow gateway on the Persian frontier, and about it I have no more to say to-night than this—that, if we cannot shut that gate and keep it shut when we like, we have missed the first and greatest lesson that this war has taught us. There is one feature about Dr. De Filippi's work which I am sure we all appreciate. We know that he took months, if not years, to prepare for it, and he collected all the scientific information that he possibly could about the wild uplands he was going to explore. He left no stone unturned to make it a success, and consequently he has been successful to a degree that we can only hope in future other scientific observers may be who follow in his steps. It is no good to start as mere travellers; men must go well armed with information, if they are to be useful. Dr. De Filippi has set us a brilliant example of what a scientific expedition should be, and yet I understand that when the first call for duty to his country reached him across those barren and wild hills, he left all his chances of further exploration and further scientific achievement behind him, and turned at once to get back as quickly as he could to serve his country; and there is surely another example for us all to think about.

The PRESIDENT: It is now my pleasant duty to ask you to give a very hearty vote of thanks to our lecturer Dr. De Filippi for the extremely interesting account of his journey, and his investigations and experiences, which he has given us. I am sorry I cannot add anything of personal experience to his narrative. I have, it is true, been in the Himalayas, and it is sometimes inferred that I and Sir Martin Conway and the Duke of Abruzzi must all have been to the same spots. An illustrated newspaper even went so far as to publish a picture of Sannu, a mountain in Sikhim, taken by Signor Sella when travelling with me, as an illustration of the Duke of the Abruzzi's exploits in the Karakoram. The region I was in was in fact about as distant from the mountains you have heard of to-night as Vienna is from Madrid, or as the Gross Glockner in the Eastern Alps is from the Monts Maudits in the Pyrenees. One point which has struck me, and which has not been noticed so far in the discussion, is the peculiar physical aspect of the mountains shown us; how much they differ both from the mountains at the eastern end of the Himalaya, near Darjeeling, and from the mountains which Sir Martin Conway and the Workmans and others have described to us. I am pleased to think my mountains, the Sikhim Himalaya, are much the most beautiful of the three. They have very, very deep valleys. You have peaks of 28,000 feet in relatively close proximity to valleys of 2000 feet. Hence you gain not only an extreme variety in vegetation but a prodigious extent of visible height. Again, the difference between the mountains of Dr. De Filippi's photographs and Dr. Longstaff's and the Duke of the Abruzzi's: in the latter you have the wildest granite pinnacles—pinnacles that exceed anything in the Alps or Caucasus—whereas round those ice-fields of Dr. De Filippi's the summit-ridges approach more to the type we are accustomed to see in views of the Arctic regions. There are no very conspicuous peaks, but any number of ridges either snowy or bare according to their exposure. Perhaps Dr. De Filippi, in adding a few words, may tell us whether it is to geological features, or to what causes he would conceive this difference between the Western and Eastern Karakoram to be due. I will not detain the meeting any longer with general remarks on the scenery

or geography of the country. I can only echo what has already been said by others on the admirable and comprehensive way in which this exploration has been carried through. I must also remind you that to-night we have only been given a preliminary sketch of the scientific results in many various branches which will be put before us whenever we have the complete records of the expedition. I will ask you to give a most hearty vote of thanks to Dr. De Filippi.

Dr. De Filippi: It only remains for me to thank you most heartily for the very kind and cordial reception you have given me. I shall leave England with the happiest memories of the welcome I have received and the generous appreciation of our work.

PSEUDO-GLACIAL FEATURES IN DALMATIA.

By Prof. J. W. GREGORY, D.Sc., F.R.S.

I. Evidence of Glacial Action.
II. Glacial Appearances in Dalmatia.
1. Subdued Relief and Rounded Rocks.
2. Bare Rock Surfaces.
3. Spurless Valley Sides.
4. Faceted Spurs.
5. Trough Valleys.
6. Hanging Valleys.
III. Glaciation in the Highlands of Dalmatia and Adjacent Areas.
IV. Absence of Glaciation from the Dalmatian Coastlands.
V. The Origin of the Pseudo-Glacial Features.

The Dalmatian coast has many characteristics which are also found in glaciated areas; and these features are so striking that if Dalmatia were situated in higher latitudes they would doubtless have been attributed to glacial action. Though this explanation has been suggested for Dalmatia, it has not been generally accepted owing to the absence of unequivocal evidence of glaciation.

It is true that some of the higher adjacent mountains in Montenegro and Hercegovina have been glaciated, and the suggestion has been made that at the same time Dalmatia stood at a higher level and shared in this high-level glaciation. If this suggestion were correct the Dalmatian features which resemble those due to ice action should be associated with positive evidence of glacial action. Such evidence is, however, lacking and the topographical features in Dalmatia which at first sight suggest the former glaciation of that country must be attributed to non-glacial agencies.

I. Evidence of Glacial Action.

The evidence advanced in favour of former glacial action consists of two kinds. The first consists of positive evidence, which includes ice-scratched surfaces, moraines, drifts containing ice-scratched boulders,

and ice-carried erratics. The second kind consists of indirect evidence, of which the chief varieties are as follows :—

1. A "subdued relief," which is characterized by gently rounded contours and absence of sharp crags or rock-pinnacles. The hills have blunt, rounded summits, and their sides often have tiers of rounded hummocks. These hills and hummocks are especially characteristic when one side is steeper and rougher than the other, thus giving rise to the "crag and tail" effect.

2. The presence of extensive bare rock surfaces, whence the decayed material due to the weathering of ages has all been swept away.

3. The absence of spurs from the walls of valleys.

4. The truncation of any remaining spurs, which therefore have faceted ends.

5. The trough-shaped form of the valleys.

6. The fact that tributary valleys are often hanging valleys.

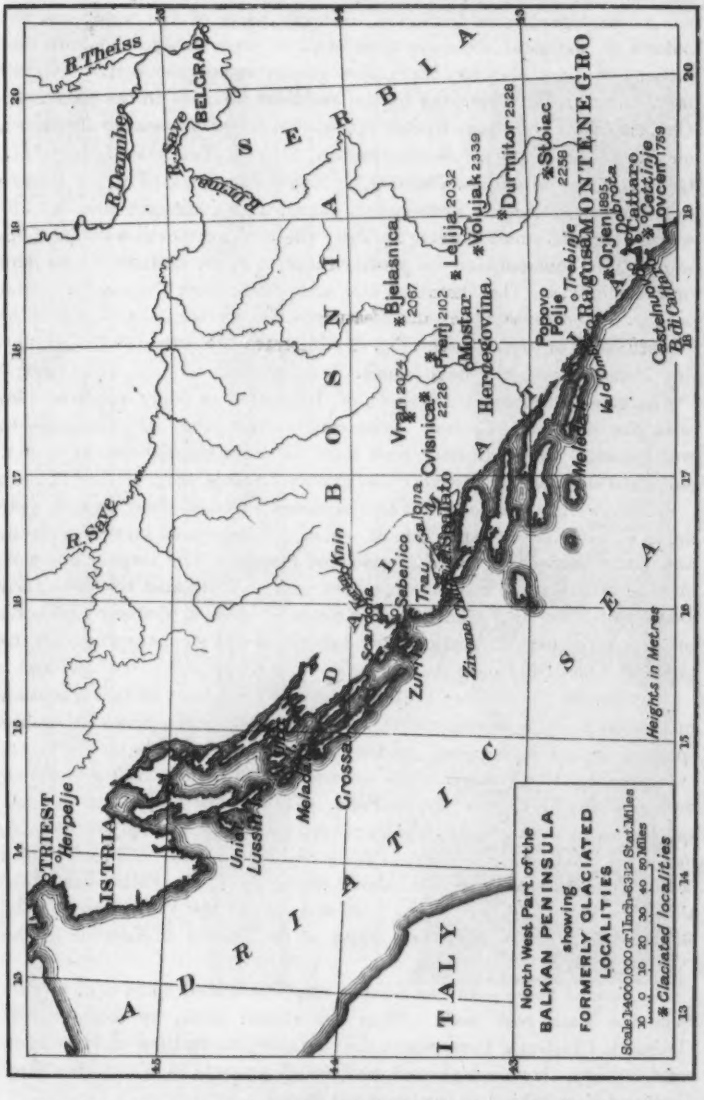
None of these six varieties of indirect evidence is by itself conclusive, though glacial action has been often claimed on one of them alone. For example, the rounded granite bosses due to exfoliation have been regarded as evidence of glacial action in India, Africa, Brazil, and Australia.

Fiords generally show all six of these features; for they occur in trough-shaped valleys; the walls are spurless or project in short faceted spurs; bare rock surfaces are abundant; many of the tributaries are hanging valleys; and though fiords are angular in course, the hills on the adjacent plateaus usually have rounded contours. These facts have been regarded as strongly supporting the glacial theory of the origin of fiords. It is interesting, therefore, to find all these features present beside the fiords on the Dalmatian coast. These inlets have been characterized as pseudo-fiords (*e.g.* Günther (1899), p. 607) for reasons which seem to me inadequate, and this view was apparently advanced mainly because these inlets occur in an unglaciated region.

II. Glacial Appearances in Dalmatia.

1. *Subdued Relief and Rounded Rocks.*—The coastlands of Dalmatia are characterized by well-rounded contours; some deep gorges and pinnacled "Karrenfelder" are exceptions to this rule, but they are recent formations by rivers and rain. The coastlands and the outlying islands have subdued outlines, and are free from crags and pinnacles. The rounded landforms in Dalmatia are the more significant since they occur on hard and often steeply tilted limestones. As we pass along the coast from the north, lands with a subdued relief are seen after crossing the Quarnero, as we look over Isola Unie to Monte Ossero on Lussin, and on the two islets opposite Ulbo. The subdued worn-down surface of the island of Sestrum has a marked resemblance to the Roseneath Peninsula on the Clyde estuary, while the island of Melada with its bolder though

rounded summits reminded me of the glaciated domes on Jura. Many



of the Dalmatian islands have forms which, if seen on the Scottish coasts, would certainly be regarded as *roches moutonnées* and attributed to

glacial action. In many of them one surface is steeper and rougher than the other, producing one variety of the "crag and tail" structure.

As photography is forbidden in many parts of the coast, and the officers of the local steamers prohibited it even outside the scheduled areas, I was not able to obtain photographs among the skerries. They may, however, be illustrated by the excellent sketches on the Admiralty Charts. Thus numerous islands shaped like *roches moutonnées* are shown on the chart No. 801, "Mediterranean, Adriatic East Coast, Sheet III., Grossa Island to Zirona Channel." Mount Moraviak (Fig. 1) is there depicted with rounded hummocked flanks, and a straight line of cliffs which occasions small hanging valleys; the off-lying Sestrice Islands are shown to be rounded like the ice-worn islands in the skerries of Scotland or Scandinavia. The sketch on the same chart from Curbabella Island to Zuri Island repeats the same features. The reproduction of the south-eastern part of that sketch (Fig. 2) illustrates the subdued topography and glaciated aspect of Zuri Island.

Lacroma (Richard I.'s Island), off Ragusa, is an easily inspected islet with the subdued relief and asymmetric section (Fig. 3). Examples of well-rounded hills with bare rock sides occur widely distributed inland, as on the sides of the Popovo Polje, and at Trebinje (Fig. 4).

2. *Bare Rock Surfaces.*—These rounded surfaces often expose wide areas of bare clean-swept rock, of which the uppermost layer is as fresh and undecomposed as in many glaciated regions. The large proportion of bare rock and of ground with very thin soil explains the proverbial poverty of Montenegro, and why Dalmatia remains so sparsely populated in spite of the money spent on it by Austria, and of its many great advantages of climate and position.

3. *Spurless Valley Sides.*—Among the first features to attract attention in Dalmatia is the prevalence of long even rock walls, which are either spurless or are interrupted by the blunt truncated ends of spurs. A typical example of these walls occurs in the Kerka valley between Scardona and the lower Kerka Falls. These walls are as smooth and spurless as those of a Scottish glacier-worn glen; and, as with the Scottish lochs, the bending of the valley is sharp and rectangular. Other examples of the spurless walls are seen above the upper Kerka Falls near Knin, along the Popovo Polje, on the northern side of the Val d'Ombla near Gravosa, and on the great face south of the Canale di Kumbur in the Cattaro Fiord.

4. *Faceted Spurs.*—In some cases short truncated spurs still project from the main rock wall. Thus the sketch given by Royle in his 'Dalmatia Illustrata' to represent the characteristic features of Dalmatian coast scenery, shows a high rock wall which projects in blunt truncated spurs and rises behind to bare rounded domes.

One method of the truncation of such spurs may be seen beside Cattaro Fiord. To the west of Cattaro Gulf, the innermost arm of that fiord, is

FIG. 1.

FIG. 2.

FIG. 3.—VIEW OF LACROMA (RICHARD I.'S ISLAND) FROM RAGUSA, ILLUSTRATING THE SUBDUED OUTLINES AND ROCHE MOUTONNÉE-LIKE FORM OF THE DALMATIAN ISLET.

FIG. 4.—VIEW NEAR TREBINJE, SHOWING THE ROUNDED HILLS WITH EXTENSIVE BARE ROCK SURFACES.

FIG. 5.—THE FIORD OF CATTARO AND THE FAULT BLOCK OF TEODS, WEST OF CATTARO GULF.

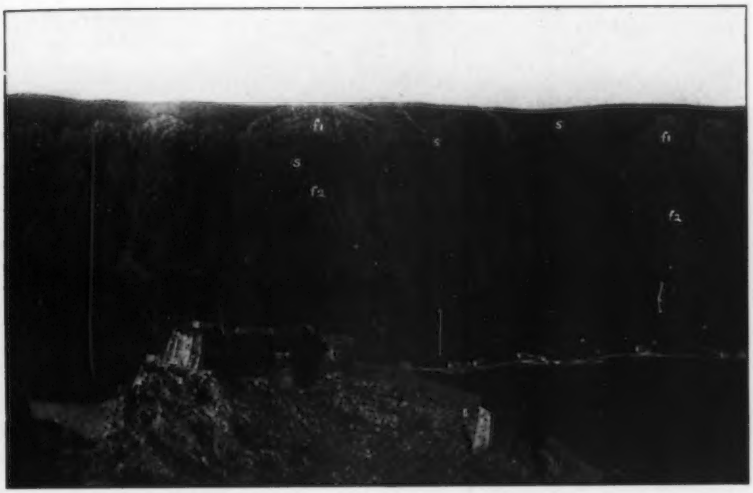


FIG. 6.—VIEW OF WESTERN WALL OF CATTARO GULF FROM THE HILLS ABOVE CATTARO, SHOWING THE FACETED SPURS AND TWO FAULT-SCARPS, f_1 AND f_2. THE BREACH IN THE UPPER FAULT-SCARP AT THE SMOOTH SLOPE (S) APPEARS TO BE DUE TO THE FAULT CROSSING A BAND OF SOFTER STRATA (S), THE STRIKE OF WHICH IS OBLIQUE TO THE FAULT.

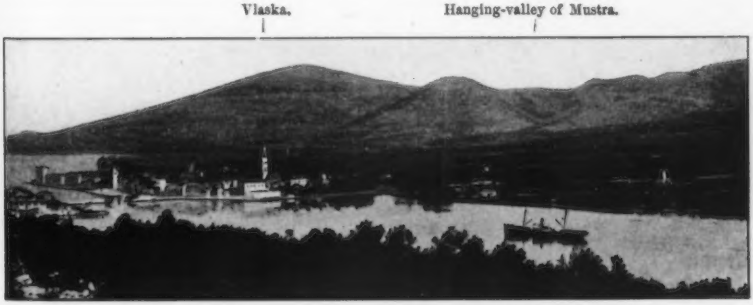


FIG. 7.—VIEW OF TRAU, DALMATIA, SHOWING THE FACETED END OF THE SPUR IN FRONT OF THE HANGING-VALLEY OF MUSTRA.

the massive fault-block which forms the Teodo Peninsula; its highest summit is Vermac (2520 feet). The fault-scarp on the southern face of this block (Fig. 5) rises sheer above the road to the west of Forta Santa Trinita, and on both sides of the south-eastern angle of the block is abundant evidence of faulting. One of the fault-lines trends north, approximately parallel to Cattaro Gulf, and this fault has cut across the eastern spurs from Vermac and thrown down their lower ends. Owing to the military regulations I was not able to traverse these spurs, and it has been suggested that the facets on them are the effect of denudation on bedded rocks of different hardnesses. This view naturally occurred to me at the time, and I rejected it for the following reasons :—

(1) If this scarp were due to denudation, greater differences would be expected between the height on the spurs and in the gullies.

(2) The bedding planes are oblique to the scarp.

(3) The effect of weathering can be recognized in the hard bands left in relief on the spurs. By the formation of branch gullies between the hard bands, denudation is attacking the spur and will in time obliterate the scarp. This destructive effect is well shown on the spur just south of the track leading to Celanovica (the middle *s* on Fig. 6).

Faceted spurs are very widely distributed in the lands east of the Adriatic, and they are due to various processes. Thus in Istria, a little west of Herpelye Koniza station, on the southern side of the valley leading to Draga, is a spur which is faceted owing to the river having cut off its end. North of Trau, as well seen from Bua Island, the spurs which project southward from the limestone ridges are sharply faceted. One well-marked facet is situated west of St. Eustacia, and forms the buttress of the summit marked on the Admiralty Chart as 1014 feet (Fig. 7). That these facets are due to faulting is suggested by their occurrence in line with the straight flat-faced scarp north of Trau Channel.

The island of Meleda, to the west-north-west of Gravosa, has on its seaward face a number of small hanging valleys separated by truncated spurs, and it appears that a fault has cut across both the spurs and valleys. A large faceted face occurs on the northern side of Val d'Ombla, west of the ferry-house. South of Malastica three sharply faceted spurs occur on the upper part of the ridge, which is there 523 feet high. South-east of Poljica and to the north-west of the Molonta Peninsula is a long straight cliff, the formation of which has produced a series of truncated spurs with hanging valleys between them.

Faceted spurs are not only present along the sea-coast, where they might be attributed to marine abrasion, but they also occur inland. Thus, examples may be seen from the railway near the head of the valley north of Sutorino. Further north two truncated spurs occur on the western side of the Canalesi basin, south of Ragusa Vecchia station ; they are on a hill face which is so sharp and regular that it suggests that the basin is due to faulting.

Along the canyon of the Narenta above Mostar the spurs have been cut back, leaving smooth triangular faces.

5. *Trough Valleys.*—Valleys with spurless, parallel walls are trough-valleys, and they are numerous in Dalmatia. The Popovo Polje has in parts, as near Turkovici, flat spurless walls surmounted by bare hummocked slopes; the aspect is that of a *moutonnée* slope, terminating below in the *roches nivelées*, to use Whymper's useful term, of a glacially over-steepened hillside. The Popovo Polje, where both sides have this character, would pass as an excellent example of an ice-worn trough-valley.

When such valleys have been drowned by entrance of the sea they form typical fiords, such as Val d'Ombla near Ragusa and Cattaro Bay. Where the hills are low and the slopes beside the arms of the sea are more rounded, the inlets, as at Sebenico and the harbour in the island of Lussin, are fiards rather than fiords.

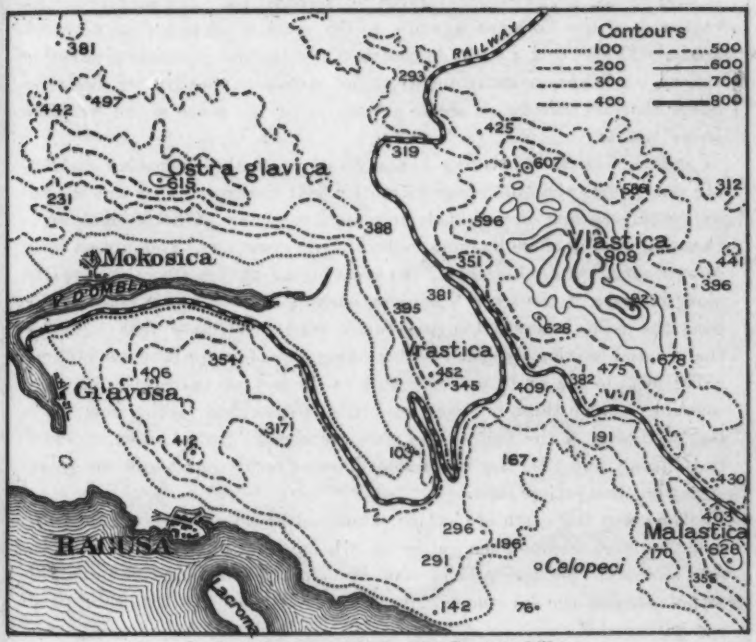
6. *Hanging Valleys.*—These valleys have been described as the most convincing evidence of the great extent of glacial erosion, and they are frequent in Dalmatia. Small hanging valleys are generally associated with truncated spurs, such as those previously referred to in Istria, near Herpelje Koniza, and in southern Dalmatia, on the sea-front of Meleda. Larger hanging valleys notch the face of the hills near Trau (Fig. 8, from the Austrian Staff map, 1 to 75,000, Zone 31, Kol. xiv.), and are used by the high-road from Trau to Sebenico, and by the railway from Spalato to Sebenico.

From Trau the road to Sebenico goes westward for 2 miles, until at the level of 153 metres (502 feet) it doubles back and crosses the southern face of Vlaska; it turns sharply to the north-north-west and enters a hanging valley between Vlaska (443 metres, 1453 feet) on the west and Vilajca (450 metres, 1476 feet) on the east; the floor of the valley slowly ascends until $1\frac{3}{4}$ miles from the entrance it is at the level of 340 metres (1116 feet); at the village of Prapatnica the level is 378 metres (1240 feet). The ridge on the western side includes the heights of 443 metres (1453 feet) at Dubgora and 738 metres (2421 feet) at Prapatnica; and the ridge to the east rises from 309 metres (1014 feet) at the shoulder north-east of Trau, to Vilajca (450 metres, 1476 feet) and Trnostak (472 metres, 1549 feet) and Labisnica (701 metres, 2300 feet). This hanging valley can be entered more directly from Trau by a track which passes through Kraj (32 metres, 105 feet) and rises by a sharp ascent to Sv. Ilija (302 metres, 991 feet), which is near the mouth of the hanging valley.

The railway from Salona to Sebenico passes through the hills near Trau by a hanging valley on the eastern side of the Labisnica ridge. The highest point of this valley is at 385 metres (1263 feet) east of Labisnica; thence it falls slowly southward till its southern end is cut off by the steep descent to the sea. At Kurtovic the level is 158 metres (518 feet), whence the valley falls quickly to Sladine (56 metres, 184

feet) and to the sea. Excellent representatives of both large and small hanging valleys occur round Ragusa. Thus on the northern side of the fiord known as Val d'Ombla, which is just north of Gravosa, there is, to the west of the village of Mokosica, a group of small hanging valleys. The village of Petrovo Selo stands on a platform between two deep narrow gorges, which have been excavated on the wide floor of the main hanging valley of this group.

SKETCH MAP OF THE HANGING VALLEYS NEAR MOUNT VLASTICA
From the 1:75,000 government map of Austria-Hungary.
Sheet Zone 35, Col. XVIII.



Scale 1:100,000 or 1 Inch = 1·58 Statute Miles

1 0 1 2 3 4 Miles

Heights in Metres

The Kobila valley, on the peninsula beside the northern entrance to the Bocche di Cattaro, may be cited as another instance of an old hanging valley, on the floor of which a younger narrow gorge has been entrenched.

Large hanging valleys occur on the inland continuation of the Val d'Ombla (Fig. 9). To the north of that inlet the land rises in Ostra Glavica to 2018 feet; to the east the mountain, Vlastica, rises to 2982 feet, and to the east-south-east of Vlastica and a little more than 5 miles due east of Ragusa is Malastica (2060 feet). Vlastica has a rounded,

blunt summit, and its spurs are all worn and rounded, so that it would pass well in a glaciated area as a typical instance of ice-worn topography; to the south between it and Malastica is a deep valley, the floor of which varies from about 1300 feet to 1250 feet. To the east the ground descends to 1130 feet at Ivanica, and the railway to Gravosa descends rapidly by two hairpin bends to the level of 340 feet, whence the valley slopes gently to the shore nearly 2 miles distant.

A hanging valley to the south of Vlastica is used by the road to Trebenje and by the railway to Castelnuovo. West of Vlastica, between that mountain and Ostra Glavica, is another hanging valley, which is used by the railway from Gravosa to Hercegovina. It descends north-eastward to the Trebinjcica, while to the south it ends, at the level of about 1000 feet, with a steep descent to Val d'Ombla. Numerous hanging valleys, which are obviously due to a main stream having greater corrosive power than its tributaries, are to be seen along the gorge of the Narenta above Mostar.

Among the most striking hanging valleys in the Dalmatian district are those along the Montenegrin frontier near Cattaro. They are shown by the hill-shading on the Austrian map, 1 to 75,000, Zone 36, Kol. xix., Cattaro. One of these hanging valleys is traversed by the main road into Montenegro. After climbing up the great zigzag the road goes northward along the face of the scarp which overhangs Cattaro; near Krstac (3160 feet) the road enters a hanging valley which continues past Vrba to the frontier station, Njegusi. This hanging valley lies between Lovćen (5771 feet) to the south and Mrajanik (4314 feet) to the north. To the south of Lovćen there is a hanging valley with a floor falling from 4570 feet at Bostur, at the foot of the main southern cliffs of Lovćen, to 4416 feet at Kuk, and 4291 feet at its mouth, which opens high above the great zigzag on the Cettinje road.

The scarp due north of Cattaro is notched by several striking hanging valleys. For example, the valley at Ml. Zalesi is at the level of 2677 feet, and it lies between hills of 4006 feet and 3665 feet, and its mouth is separated from the sea below, 1200 yards away from it at Dobrota, by a precipitous cliff.

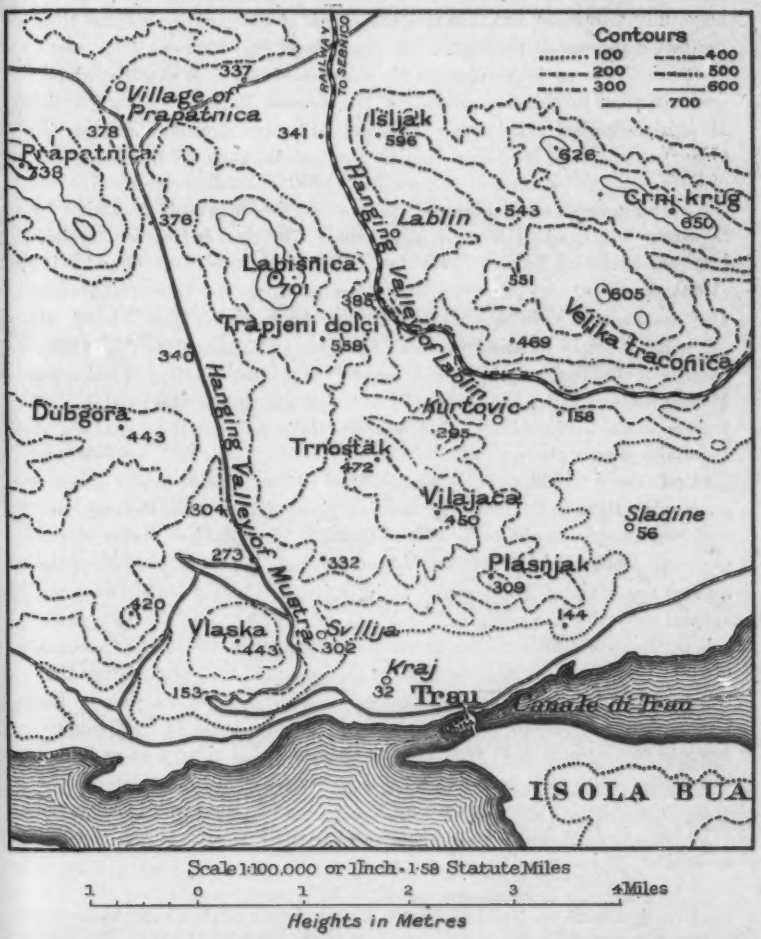
The examples above Cattaro are perhaps as impressive hanging valleys as can be found anywhere in Europe. They are clearly of tectonic origin, and are due to the faults which formed Cattaro Gulf.

III. Glaciation in Dalmatia and the Adjacent Areas.

The resemblance of so many of the topographic features of Dalmatia to glacial forms is so striking that it is difficult when visiting the country to resist the conviction that it has been glaciated; and this conclusion may seem the more reasonable since it is now known that glaciers once existed on the adjacent mountains. These glaciers were however small,

and they were limited to the highest summits. The geologists who studied the more accessible parts of the Balkan Peninsula reported that in spite of careful search they could find no traces of glacier action. Thus von

SKETCH MAP SHOWING POSITION OF HANGING VALLEYS NEAR TRAU
From the 1:75,000 government map of Austria-Hungary. Sheet Zone 31 Col XIV.



Mojsisovics (1880, p. 212), in a report on the geology of Bosnia and Hercegovina, quotes the conclusions of Boué and von Hochstetter as to the absence of glacial action in the Balkans, and supports them by the investigations of himself and his colleagues, Neumayr, Bittner, and Teller.

He concludes that "the proposition can now be advanced with reasonable certainty that the whole Balkan Peninsula was free from glaciers at the glacial period." He states that his fellow-travellers and himself, in spite of their experience in recognition of traces of glacier action, had during their journeys in Bosnia and Hercegovina "nowhere found any certain indications of the existence of old glaciers." Though this view has not been fully confirmed, it illustrates the rarity of glacial remains and their limitation to some of the higher mountains (see Fig. 10).

Prof. Cvijić, in 1900, asserted the absence of moraines or other glacial evidence from the higher summits of the western Balkans and of Servia. He had described previously (**1898**, pp. 242–246) moraines and corries (Kare) on the Rila Mountains in the Central Balkans, to the south-east of Sofia; and he subsequently announced (**1900**) the discovery of numerous corries and some local moraines on the higher mountain summits of Southern Bosnia and Hercegovina. Prof. Cvijić recorded these moraines from the height of 4829 to 5240 feet in the mountains near Treskavica (**1900**, pp. 16–18), at 5994 feet near Prenj (*ibid.*, p. 35), and at 7546 feet at Studenac near Volujak (*ibid.*, p. 55); he also recorded (*ibid.*, pp. 68, 88, etc.) glacial traces on the Durmitor (8294 feet). Katzer (**1903**, p. 54) has described the Black Lake (Crno Jezero, 5512 feet) on the Treskavica Mountains as moraine dammed. Prof. Cvijić also infers the existence of former glacial action in the north-western Balkans from the existence of numerous corries there.

Prof. Penck (**1900**, p. 161) has described the remains of former glaciers on Mount Orjen (6217 feet), the meeting-place of Dalmatia, Hercegovina, and Montenegro, to the north-east of Cattaro: and glaciers also occurred (see *e.g.* Penck, *ibid.*, p. 174) on Mount Lovćen (5771 feet), which is the highest mountain of Montenegro, and overhangs Cattaro. On Orjen the ancient snow-line according to Penck was at 4600 feet, and on the western side of the mountain a glacier descended to 3600 feet. In a later account of the Orjen moraines von Sawicki of Cracow (**1911**, p. 343) claims that the moraine of the Pod Vratlom glacier, a small isolated member of the Orjen group, can be traced on the Kameno plateau, north of Castelnuovo, down to the level of 2133 feet, and he estimates that the old snow-line of this glacier must have been as low as 3870 feet. The south-eastern lobe of the main Orjen glacier, according to von Sawicki, descended as low as 1970 feet (*ibid.*, p. 350); and he estimates that the Orjen glaciers covered an area of 39 square miles.

IV. Absence of Glaciation from the Dalmatian Coastlands.

Even with the extensions traced by von Sawicki the Dalmatian glaciers were confined to high levels, and they indicate only a restricted local glaciation. Prof. Penck has remarked (**1900**, p. 176) that the glaciers were small, and all known at that date, except on Orjen, were limited to

one side of the mountain summits. Hence there is no probability that glaciers flowing from these snowfields could have reached the coast. Prof. Penck expressed surprise (*ibid.*, p. 163) that these glaciers should have extended to the level of below 4000 feet near a coast on which grow southern fruits and palms: he therefore regarded the former existence of these mountain glaciers as evidence that the whole country has subsided since their date. He referred in support of this view to Roman remains a metre below sea-level near Spalato as indicating a post-Roman subsidence of the coastlands.* It is along the coast and at low levels that the features most resemble ice-worn forms; and with this opinion Prof. Katzer fully agreed during a conversation at Serajevo. The hypothesis that glaciers existed in recent times at sea-level on the Adriatic about the latitude of Rome appears incredible. The idea therefore suggested itself that the coastlands in glacial times might have been at a higher level, so that they shared the high-level glaciation, and that the glaciated country has subsequently sunk to sea-level. The recent foundering of the Adriatic and the abundant evidence of late Kainozoic faulting on the Dalmatian coast gave this explanation some plausibility; and it is consistent with Katzer's conclusion that the glaciation on the Dinaric Alps "happened before the subsidence of the northern Adriatic" (Katzer, **1911**, p. 419). But if this hypothesis were correct the Dalmatian lowlands should contain positive evidence of glacial action, such as glaciated rocks, moraines, and erratics. The absence of striations from the bare rock surfaces may be readily explained by their obliteration by weathering. I therefore, at several favourable positions, stripped off the turf and examined protected rock surfaces, but without finding any trace of glacial scratching. Moreover, I did not see, except on the mountains inland, any moraines, or any drifts with glaciated stones, or erratics.

V. The Origin of the Pseudo-Glacial Features.

In the absence of any such positive evidence of glacial action, it seems clear that the physiographic resemblances to glacial features are not due to glaciation. They are pseudo-glacial.

The rounded hills may be explained as down-like forms due to the weathering of limestone. The "crag and tail" is due to the moulding of dip slopes and escarpments in hard jointed limestones. The bare rock surfaces are doubtless due to the combined effect of wind-erosion during

* I have previously suggested (**1913**, p. 196) an explanation of these facts which is consistent with the abundant evidence that there has been no change in the general level of the Dalmatian coast since Roman times. Dr. A. Gavazzi of Agram has summarized the classical and historical references which suggest changes on this coast; and he concludes that during the past two thousand years there have been horizontal movements of the shore-line, in some places inland and in others seaward, but that there is not a single trace of any vertical movement of the land due to subterranean forces (Gavazzi, **1912**, p. 152).

the dry hot summer, and to the poverty of the local rocks in coarse and insoluble material. Most of the rock waste is removed in solution. The spurless walls are the result of faulting and of the cutting back of the spurs by wind and rivers guided by jointing.

The hanging valleys are due in some cases to faults, whereby the upper ends of old valleys and the inner parts of plateaus have been left upstanding, while their former seaward extensions have foundered beneath the Adriatic. Many of the hanging valleys are due to the enlargement of a main valley by river-erosion; and this process has been aided by the porosity of the rocks, which reduces the volume and power of the tributaries. Much of the drainage passes underground, and the valleys are deepened by the collapse of the roofs of the subterranean stream channels. The conditions which control river-erosion in these hard jointed limestones are somewhat abnormal; the tributaries do not cut their valleys to the base-level of the main streams as readily as where the rocks are less porous and contain more insoluble material. In fact, in some cases hanging valleys have been formed, as at both the upper and lower Kerka Falls, by the river having built a tufa barrier across its channel, which has thus been raised above its normal level (Gregory, 1911, pp. 540–543).

There is no evidence of glacial action on the Dalmatian coast, and the features which are so strikingly similar to those of other glaciated areas are due to denudation by other than glacial agencies. The Dalmatian hanging valleys, truncated spurs, oversteepened slopes, overdeepened valleys, spurless walls, trough-valleys, and rounded subdued relief are not due to glacial erosion.

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THE MACCLESFIELD DISTRICT.

I. PHYSIOGRAPHY.*

By B. W. BAKER.

§ 1. Introductory. § 2. Main Regions and Early Cycles of Erosion. § 3. The Pre-Eocene Cycle. § 4. The Post-Eocene Cycle. § 5. System of Folding and Pennine Foothills. § 6. Glacial Incident and Cheshire Plain. § 7. Summary of Physiographical Evolution.

§ 1. *Introductory.*

The Macclesfield sheet of the 1-inch Ordnance Survey Map (No. 110) embraces an area of 12 miles by 18, Macclesfield itself lying in the north-east corner, while the other corners are marked approximately by the sites of Leek (south-east), Crewe (south-west), and Northwich. This tract of country forms part of the Midland Gate—the depression which separates the Pennines from the Welsh upland—and while it belongs mainly to the Cheshire plain, its eastward quarter consists of the foothill ranges of the Pennines. Here we have two natural regions which are readily distinguished in the contour map (see Map 2). It will be most convenient to take as a line of separation the 600-feet contour, when the relative areas to be assigned are—Pennine foothills, 18·6 per cent., Cheshire plain, 81·4 per cent. An analysis of the land-forms and physical structure of the district derives most of its interest from the strong contrasts presented by these natural divisions, and it will appear later that the sharply defined boundary along which they meet has a special significance in the physical history.

It will be well first to summarize the characteristics of our Hill and Plain sections. The Pennine country is one in which Carboniferous strata have been strongly folded into alternate anticline and syncline, the result being a series of steep-sided ridges oriented north and south: the summits of these are comparatively bare, with only a covering of rough grass or heather, and an occasional plantation of firs, while the valleys are deep ravines or cloughs where the picturesque streams are often buried in dense copse and oakwood. In contrast with this, one views the Cheshire lowland

* Maps, p. 172.

as an undulating country sloping almost imperceptibly to the west, and diversified by a greater variety of trees and hedgerows: the woods are, however, small and scattered, and Cheshire is essentially an area of park-land. The soil of the lowland consists of a thick covering of glacial clays, with sand and gravel of like origin, the solid foundation of Triassic rocks being in most parts concealed from view. The south-western part of the sheet is composed of salt-bearing strata between Alsager and Middlewich.

A reference to the hydrographical map (Fig. 1) shows that a distinctive system of drainage belongs to each of our natural regions. Among the hills a corrugated surface has compelled the main streams (*e.g.* the upper Dane, Biddulph Brook and Shell Brook) to run north or south along ready-made synclinal depressions: in isolated cases also (*e.g.* headstream of Trent) erosion has produced anticlinal valleys. The rivers of the plain, however, take a direction consequent on the existing slope, and their course is slightly north of west. Among these consequent streams the Dane is conspicuous. Its sinuous and trough-like valley is clearly traceable in the contours, cutting clean across hill and plain alike. This river, along with the Wheelock which joins it near Middlewich, is ultimately tributary to the Weaver. The latter indeed receives most of the drainage of the area, only a small tract about Macclesfield and Langley belonging to the Bollin and thus feeding the Mersey. In the south-east the head-streams of the Trent rise near Biddulph; it is important to note that these south-eastern hills are the watershed dividing Trent and Weaver Basins, and so form part of the main divide for England and Wales. Here the water-parting is cut across by two remarkable depressions or gaps—at Mossley and Rushton—affording easy routes across the projecting corner of the Pennines, and giving easy communication with the Potteries and Derbyshire.

§ 2. *Main Regions and Early Cycles of Erosion.*

With these remarks by way of preamble we may proceed to a fuller analysis of the relief. Such an analysis should be genetic in plan, utilizing the concepts of Structure, Process, and Stage, which have been rendered familiar words by W. M. Davis (see 'Geographical Essays,' pp. 249 *sqq.*, and *Geog. Jour.*, 14, pp. 481 *sqq.*), its aim should be to show how, during a succession of physiographical cycles, an original rock-structure has been re-modelled or modified by erosive and constructive agencies until the existing surface features were evolved.

Keeping this method in view, we must first state in general terms the geological facts on which the contrast of Plain and Foothills may be said to depend. It is a commonplace of text-books that the Pennine upland is formed of the older and generally harder Carboniferous strata, the lowland of softer Triassic deposits, mostly sandstones and marls: further, that the effect of denudation has been to wear down the Trias to a horseshoe

of lowland encircling the southern Pennines, while the more resistant Car-

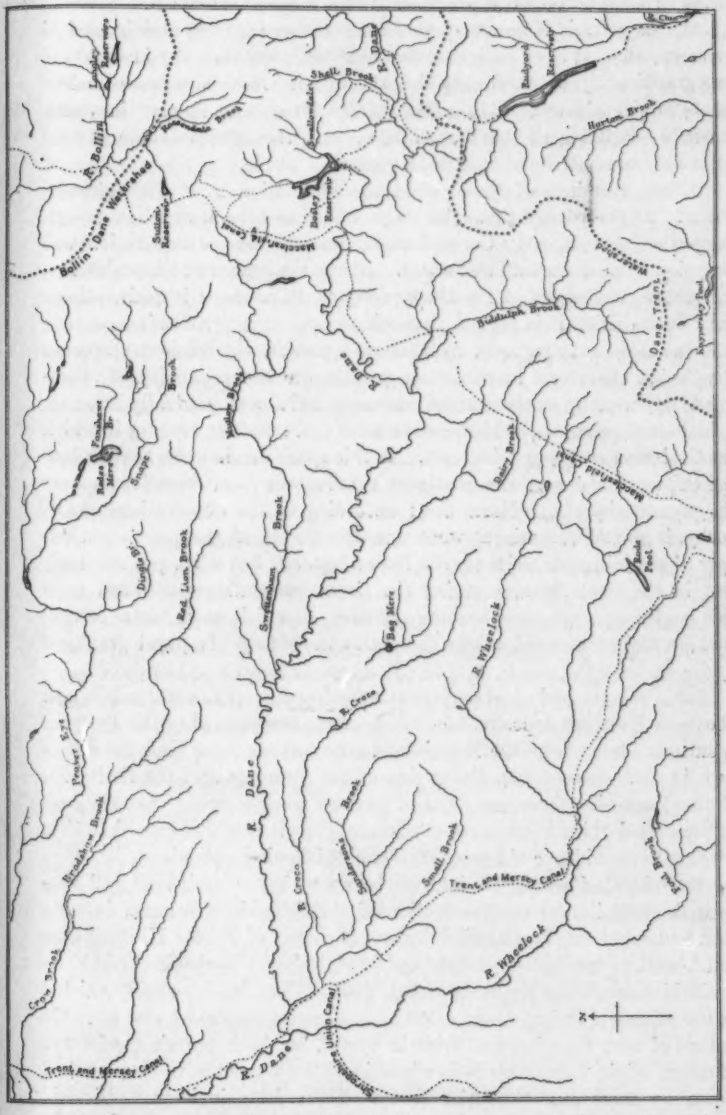


FIG. 1.—HYDROGRAPHICAL SKETCH OF MACCLESFIELD DISTRICT.

boniferous tract remains in high relief. Such an argument attributes the Red Plain entirely to differential erosion, and while that explanation is

useful as a first generalization, further inquiry will convince us that tectonic forces have been even more prominent in the chain of causation.

At this point it is necessary to discuss rather fully the stratigraphical evidence, since it is on such evidence that we must base our ideas of the topographical cycles through which the district may have passed. The whole subject is treated in a thoroughly interesting manner in Jukes Brown's 'Building of the British Isles,' and the most valuable part of what follows is borrowed from that work.

In the Pennines of Macclesfield the foundation is of Carboniferous strata. At the base of the series stands the limestone, a deep-sea deposit suggesting that in early Carboniferous time the site of this region was occupied by deep seas of clear water. Above the limestone lie sandstones, mudstones, and shales of the Pendleside and Millstone Grit Series; from their composition it is argued that middle and upper Carboniferous time saw the deep seas replaced by shallower waters, the lenticular beds of Pendleside crowstone in particular pointing to the proximity of shore-lines. So we may suppose these waters to have been gradually filled in, a final stage being marked by shallow lakes and estuarine swamps in which the Coal-Measures were laid down. In this epoch one has also to postulate the existence of a northern continent running out from Scandinavia over the present site of the North Sea; according to the observations of Dr. Sorby, it was this continent whose granites furnished the quartz and felspar of the Millstone Grits (Jukes Brown, *op. cit.*, 3rd edit., pp. 162–163). But in the Coal Measure period the rivers descending southward from this land-mass must have become extremely sluggish, their basins having that low and well-graded relief which marks the old age of a physiographical cycle.

In the regular geological sequence Carboniferous rocks should be followed above by Permian deposits. It will be seen, however, that the Permian is entirely absent from the Macclesfield area; at the same time the difference in these deposits on either side of the Pennines and the limitation of the Magnesian limestone to their eastern margin, prove that the seas of the period did not submerge our area. Thus it is in Permian time that we first have evidence of a separate Pennine island or upland.

Elsewhere, of course, the interval between the Carboniferous and Permian is occupied by the production of the Armorican flexures running east and west, the Lancastrian flexures (*e.g.* that of Pendle Hill) running south-west to north-east, and the upfold of the South Yorkshire, and Derby coalfield (*vide* Jukes Brown, pp. 191, 299). That land actually existed in the Midlands and northern counties is a conclusion drawn also from the nature of both Permian and Triassic strata, for both contain sandstones of desert origin and pebble-beds whose ingredients must have been washed down by large and torrential rivers. These facts indicate a climatic *régime* such as is found to-day in the inland drainage areas of south-western Asia.

In speaking of the Triassic age, however, one must carefully distinguish between the earlier Bunter sandstone and later sandstones or marls of the Keuper series. Both series occur in our district in small exposures, namely, at Sutton reservoir, Mow Cop, and Rudyard, while they may be presumed to exist under glacial deposits throughout the Plain. The conclusion drawn in the Geological Survey Memoir (Sheet 110, edited by T. J. Pocock, 1906) from the sporadic occurrence of Trias is that the Pennine upland of Permian time continued in existence while the whole Triassic succession was being laid down in the surrounding seas or their re-entrant arms. Mr. Mackinder argues to the same effect in 'Britain and British Seas' (p. 65).

The evidence on this point to be derived from the Macclesfield area is certainly difficult to interpret. The fact that Bunter deposits occur in the Rudyard Gap and run through into the Churnet Valley seems to support the view taken by the Geological Survey. On the other hand, at Whitemoor Hill the Keuper sandstone is admitted to have taken part in an anticlinal fold (Geological Survey Memoir, p. 61), from which one would conclude that the Keuper had transgressed the underlying rocks at Whitemoor previous to their final uplift. The problem is, of course, one which cannot be solved from a consideration of a single locality, and a more general survey only convinces one that it is most essential to consider the Bunter and Keuper deposits separately. The seas of Keuper time had undoubtedly the wider extension, and Jukes Brown states without hesitation that the uppermost member of that series—the Keuper marl—transgressed the whole Pennine area. Perhaps one may summarize by saying that while the Permian age saw an upland on the site of the southern Pennines, the Bunter witnessed a partial subsidence, and that the downward movement continued in Keuper times, ending with an almost total submergence when the Keuper marl was formed.

From evidence so far considered it would be possible to distinguish a Carboniferous cycle of erosion, during which the Pennine land was very nearly 'base levelled,' and a second cycle initiated by the uplift at the beginning of the Permian. In both cases, however, the indications are extremely vague. It seems impossible to determine the height of the uplift, its form or the amount of denudation it suffered, or even the manner of its final reduction. As Jukes Brown says, "The original uplift of the Pennine range was pre-Permian, and not of a date between Permian and Triassic time. The uplift, however, was not great and the ridge produced of no great elevation, for, as we shall see, the Trias probably passed over it. The broad anticlinal curvature of the whole region was clearly produced at a much later date, because both Trias and Lias are affected by it" (*op. cit.*, p. 192).

§ 3. *The Pre-Eocene Cycle.*

We have next to discuss the evolution of the district in Jurassic, Cretaceous, and early Tertiary times. In the Macclesfield area the Keuper

marl is succeeded by glacial deposits of Pleistocene date, so that no trace remains of the Jurassic, the Cretaceous, or the whole Tertiary succession. It is, however, most probable that the strata just named did overspread the area, and have been lost by a process of denudation which we shall shortly consider. Meantime we may note that the former transgression of these lost deposits rests upon the occurrence of Jurassic outliers in Cheshire, near Carlisle, and again in Skye and Raasay, as well as on the existence of chalk in Antrim and the dredging of chalk pebbles from the bed of the Irish Sea. These facts support the conclusion that at certain stages in Jurassic and Cretaceous time northern England was again well covered by the sea. But the north-western continent, which has been mentioned under the Carboniferous epoch, still extended from western Ireland towards Scandinavia, its southern shore undergoing numerous oscillations in Mesozoic and Tertiary time. The south-eastern flank of this land-mass having received its covering strata of the Mesozoic, there followed an increased uplift of the northern plateau, and a fresh cycle was initiated (Pre-Eocene cycle) of which it is possible to form a much clearer conception. We may suppose this cycle to have been well advanced by the London Clay division of the Eocene, when the continent probably had a southern shore-line near the present Oolitic scarp running between Dorset and the Wash. The general surface formed an inclined plane rising towards a northern watershed which ran from the present Donegal upland across to Scandinavia, and the land was eroded by long rivers running from the Donegal ridge towards the east and south-east. We still possess some evidence for this erosion-cycle in the gradually decreasing height of our hill summits from the Grampians southward, while its drainage lines are apparent in the whole "graining" of our island. Consequent valleys of the period are well shown in Scotland in Loch Shin, Loch Maree, the sound of Mull, and a host of other depressions; while in the Macclesfield area the Rudyard Valley may very well have originated in the same early cycle.

This same cycle was destined to a fresh interruption, so far as the Pennines are concerned, by regional uplift, and as there is good reason to refer this disturbance to the Eocene epoch, the title "pre-Eocene" will so far be justified.

§ 4. *The Post-Eocene Cycle.*

The pre-existing drainage consisted, as we have seen, of the east-flowing Donegal rivers. Now we have to imagine the Pennine upland erected across the path of these streams—a series of anticlinal ridges running mostly north and south and effecting a complete change in the relief. The reasons for ascribing these Pennine ridges to the Eocene period are fully discussed by Jukes Brown (*op. cit.*, pp. 378 *sqq.*). He uses the arguments already mentioned to show that the earlier Pennine upland did not persist to the end of Cretaceous time: whence it remains to choose for

its later upheaval in Tertiary time either the Eocene or the Miocene, the latter having been supported by Dr. Marr (*Q. J. G. S.*, 1906, pp. 86 *sqq.*).

Against the Miocene date one may quote the thickness of covering strata that has been removed since the uplift occurred, the later date hardly allowing sufficient time for this. In favour of the Eocene two considerations may be mentioned—(1) In Eocene times volcanic activity and crustal movement were widespread in the British area: (2) whatever conclusion may be reached as regards the main anticline of the Pennines, the diverging ridges in which the upland terminates southwards (those, namely, of the Leicester, Warwick, Staffs, and Shropshire coalfields) actually contain doleritic intrusions like those which in western Scotland are allowed to be of Eocene date.

On the first of these points one may note that, while the chief volcanic flows occurred in Scotland and Antrim, no such phenomenon is to be observed in England: even the igneous dykes of the northern Pennines are lacking further south. This absence of surface flows, however, only suggests that the Pennine uplift was connected with a later phase of the disturbances, when their violence had somewhat abated, but was still sufficient to account for the dome-shaped swelling of the Lake District.

In connection with the second point, it should be observed that the 1-inch geological map of Macclesfield (Sheet 110) shows an exposure of volcanic rock at Astbury, near Congleton. The Geological Survey Memoir makes this rock contemporaneous with the Carboniferous limestone: but the matter is not discussed in full, and on the analogy of the other Midland localities one would imagine this to be only another intrusion of Eocene dolerite.

The history of this margin of the upland will be further elucidated by considering the peculiar nature of the boundary on the west side. The Foothills terminate abruptly along a fairly straight line connecting Harecastle (Sheet 123) and Macclesfield—a line which is roughly identical with the 600-feet contour. A similar direction is pursued by the hill margin as far north as Stockport, and one observes that, apart from the westward projection of Alderley Edge, contours in general pursue a remarkably unbroken course between Stockport and Newcastle (Staffs). This statement applies especially to the 400, 500 and 600-feet lines which contrast with those of the eastern Pennines in the same latitude.

This hill-face, marking as it were the outer ramparts of the Pennines from Mow Cop northward, will be recognized at once as an escarpment. It is not, however, a denudation feature like the limestone and grit scarps so common in Pennine counties: it is an ancient fault scarp accompanying the Red Rock fault which for a considerable distance separates Carboniferous upland and Triassic lowland. The fault is traced carefully by the Geological Survey, and is named from the red Triassic sandstones which it throws down to westward. One may emphasize the downthrow because, in the opinion of Dr. Hind, the movement has been in the Triassic rocks

(*vide* 'Geology in the Field,' p. 567). Entering our district from the south at Red Bull, the fault runs north-east to Dane in Shaw, near Congleton, then nearly north, cutting the river Dane near North Rode viaduct, and being subsequently lost under the glacial clays. It has been seen again at Sutton reservoir and near Macclesfield.

Mr. Wedd suggests that the total downthrow may amount to as much as 1800 feet ('Geological Survey Memoir,' p. 111). Whether this was caused suddenly or gradually accumulated, the net result has been to dislocate entirely the Mow Cop anticline, whose western limb has long vanished from sight (see Fig. 6). The fracture therefore shows the Eocene folding to have been exceptionally severe along this western margin. When one further considers Jukes Brown's suggestion that the Irish Sea depression was probably the result of subsidence following the same disturbances, one is able to view all these features—Pennine ridges, fault-scarp, and Irish Sea trough—as connected in the same causal sequence. It should also be remarked that the Cheshire plain is bounded both east and west by fault lines (see Fig. 2), so that this section of the Midland Gate is essentially a rift valley similar to the central Scottish lowland.

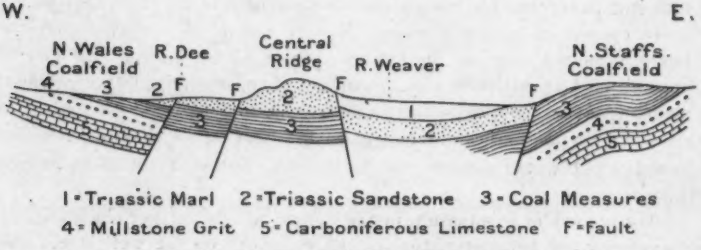


FIG. 2.—SECTION ACROSS THE CHESHIRE PLAIN.

The dislocation along this Red Rock fault had as its first outcome the erection of an abrupt fault scarp facing west and towering to a height of something like 1800 feet above the adjoining plain. For ages after Eocene time there must have been this continuous feature dominating the landscape, and Mr. De Rance, in dealing with the evolution of the drainage system (*Staffs Sentinel*, Summer Number, 1908), assumes that it acted as a water-parting right up to the Glacial epoch. But this once continuous ridge has since been broken down by erosive agents, its foot being buried in thick drift deposits, while the actual scarp has retreated about a mile from its original position. Thus it should be of interest to observe certain land forms which yet remain to show that this was originally a genuine fault scarp.

The ideal fault scarp has been analyzed by W. M. Davis from examples among the basin ranges of the United States ('Geographical Essays,' pp. 725 *sqq.*), and he suggests the following as the essential features of this type of scarp :—

(i.) An upland terminating in a straight base line, *i.e.* lacking the regular alternation of spurs and re-entrants;

(ii.) Side valleys, where found, standing at some height above the surrounding plain;

(iii.) All side valleys having a V-shaped section down to their mouths, and thus distinct from the normal river valley;

(iv.) The existence of gravel or alluvial fans at the mouths of such valleys.

This list may be made more complete by adding a point mentioned by De Martonne ('Geogr. Phys.,' 2, p. 556), namely:—

(v.) The absence from the plain of any outliers (*buttes témoins*) belonging geologically to the upland.

In applying any of these criteria to the Macclesfield scarp one has to remember that the basin ranges with which Professor Davis deals are in a dry climate by which land-forms of ancient origin are preserved through a great length of time, whereas the dampness of the English climate tends to efface some lines of evidence, the consequences of the glaciation also being important.

One may, however, safely state that conditions (i.) and (v.) above are satisfied by the Macclesfield scarp. Reference has been made to the straightness of the base-line, and there appears to be no trace of any outliers of the Carboniferous. Such outliers of course might exist buried under the drift in Cheshire; but sections mentioned in the 'Geological Memoir' are not reliable, and one knows that even at Congleton, on the very edge of the plain, there are 900 feet of Keuper marl above the Carboniferous base.

Conclusive evidence on the other points would not be expected, considering the lengthy processes through which the region has passed since Eocene days. Thus the present side valleys cannot be described as V-shaped, those of Langley and Rossendale being rather broad. The existence of gravel-deposits, however, on the fault-line is noticeable. These are found at the mouth of the Langley Valley near Sutton and in the Dane Valley at Congleton. The Sutton gravels are half a mile wide, 2 miles long, and in places 12 feet deep ('Geological Memoir,' p. 88). In their present position these are doubtless deltaic deposits laid down in a glacial lake (*vide* p. 33 of the Memoir); but it is very doubtful whether a thickness of 12 feet was accumulated during glacial times, and part of the material at any rate may have been laid down previously at the foot of a fault-scarp. In the Dane Valley also it is noticeable that gravel beds begin exactly where it is crossed by the fault-line.

On all these grounds we may regard the hill-slopes behind Macclesfield as the relics of an old fault-scarp now in an advanced stage of decay. Other localities in which the Pennine upland has a similar termination are those of the Pennine (Eden Valley), Dent and Craven faults; a useful comparison might be made between the four examples. On a wider view,

and disregarding the geological detail, we may see in the Red Rock scarp a feature comparable to the "fault-line" of the Atlantic states, each deriving some economic importance from the alignment of trade centres along the boundary of hill and plain.

But whatever the origin of the hill-margin, it is clear that from the time of the Eocene flexures it formed a continuous ridge and was also a water-parting. Of the gaps by which it is to-day broken up those at Mossley and Rudyard are especially remarkable; for while the former of these now drains northward to the Dane, the drainage of the Rudyard trough has apparently always escaped to the south. The explanation of these anomalies involves a discussion of the Glacial age in the district, and will therefore fall under that section of the post-Eocene cycle which may be termed the Glacial episode. What now remains to be told of the physiographical history may be conveniently treated under (*a*) System of Folding and the Pennine "Foothills," (*b*) Glacial episode and the Cheshire plain.

§ 5. *System of Folding and the Pennine Foothills.*

If the arguments already urged are correct, the Pennine system of flexures dates from Eocene times, though it is certain that the forces of upheaval were then acting along the lines of a previous uplift which may be referred to the Uralo-Permian period. In the Macclesfield area the hills are best described as foothills, since the main anticline lies about 10 miles east of Macclesfield and beyond the Goyt syncline. Throughout the whole upland a precise analysis of the structure is difficult, because the surface is generally covered with peat and moorland, making sections impossible to obtain except along the watercourses: the fact that folding has been severe and accompanied by repeated faulting does not make the geologist's task any easier. However, a survey of the relief map, p. 172, in conjunction with the sections available will give a fairly adequate idea of the process of mountain-building which has originated the hill country. The general impression produced is that of a corrugated surface, due to a number of minor upfolds running more or less parallel to the main anticline near Buxton; thus the general type is that of the Ketten or Chain Jura, and results in something like the same "gridiron" type of drainage.

Here we may observe that in the upland generally differences of "facies" in the component rocks are responsible for a certain variety in the land-forms. The whole Pennine area may be said to offer a considerable range of landscapes, from limestone Karst and canyon, through monotonous plateaux, where the Grit strata carry wide stretches of heather, or narrow ridges separating wooded glens, to the highest Grit-capped summits which are analogous in structure to the American "mesas." The Macclesfield foothills, without embracing the whole of this range, still offer their own points of interest. The Millstone grits are massive sandstones of coarse texture; being hard and of rectangular structure,

they give rise to those abrupt and often continuous escarpments which are well distributed over the Pennines. The generic title for these is Edges—a name frequently encountered in this and the adjoining districts. Again, the Pendleside crowstones, which are quartzites more homogeneous in composition, weather more evenly and produce solid bosses, rounded in profile and commonly elliptical in plan. The rock is described as follows:—

"The normal type of Crowstone is quite distinct from the Millstone grit. It is a close-grained quartz-rock, hard and brittle, yielding good material for roads, but useless as building stone. Under the microscope it is shown to consist entirely of quartz grains with a matrix of silica deposited in optical continuity with the original constituents. It may

FIG. 3.

therefore fairly be termed a quartzite" ('Geological Survey Memoir,' Sheet 110, p. 8). To the Grit type belong Cophurst and Congleton Edges, whereas Lask Edge, being a crowstone height, is incorrectly named. Other examples of the latter type are Gun Hill, Sutton Common, and Bosley Minn; from the contour maps shown in Fig. 3 a definite idea of the crowstone boss may be obtained. In its rounded profile and uniform covering of grass it forms a northern counterpart to the Chalk Downs of southern England. The elliptical plan is due to the fact that the structure is generally a pericline, in which the resistant nature of the core has united with the steep dip all round to preserve the mass against erosion. Hence its effect on the drainage system, the streams being few and appearing on the lower slopes. The whiteness of the crowstone screes and walls also contrasts with the brown tint assumed by the Grit rock after prolonged exposure. It should be noted that the Pendleside quartzites have only a limited

distribution in this country, and that their unusual development between Macclesfield and Leek forms a distinctive feature of the district.

While the grits and quartzites form the hard skeleton of the structure, both series also contain softer shale-beds; wherever erosion has access to these, they are readily worn down, and it is along the shales that the main streams have deepened their valleys: this is clearly seen in the case of the Rossendale and Shell Brooks.

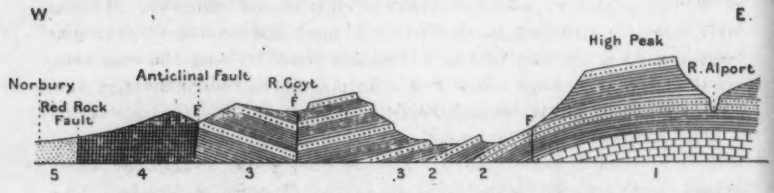


FIG. 4.—SECTION THROUGH NORBURY AND HIGH PEAK.

Returning now to the structure of the foothills, a few sections will suffice to show the relative positions of the upfolds and downfolds. The section in Fig. 6 is taken from the original Geological Memoir on the Stockport area (Sheets 81, N.W. and S.W., ed. Hull and Green, p. 12). It is drawn a little south of Stockport, and shows the main anticline rising in the High Peak with a capping of Grit (summit, 2088 feet). West of this the five members of the Grit series are depressed in a synclinal valley occupied by the river Goyt. Then follows a subsidiary anticline, the axis of which is followed by the anticlinal fault and the Saltersford valley.

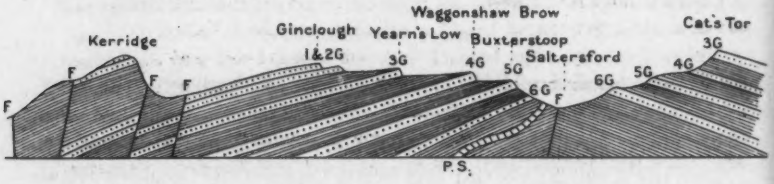


FIG. 5.—SECTION THROUGH KERRIDGE AND CAT'S TOR.

The western half of this section is practically repeated in Fig. 5, which shows the structure at Kerridge immediately north of Macclesfield.

The anticlinal fault is again seen at Saltersford, while the successive beds of Grit form on either side of the valley a succession of scarps facing inwards. On the western limb of the anticline it is seen that the whole series from the 6th up to the first Grit is involved, while the summit of Kerridge Hill is of Coal-Measure sandstone.

The axis of the upfold just described crosses the north-eastern corner of the Macclesfield area, where a level expanse of fifth Grit occupies the

summit of Macclesfield forest (1550 feet). The same anticline is considered to run south-east through Shutlingslow, in the Buxton area and to reappear in Gun Hill east of Rudyard Lake. From Macclesfield forest the ground dips westward with the strata, successive escarpments, of the other grits facing up the slope. The fourth Grit forms a separate feature at Windyway Head, but the most remarkable of these scarps is that of Tegg's Nose, towering in a 600-feet cliff above Langley: its height is probably due to the uniting of four of the Grits, all being cut off by a fault along their eastern face. West of Tegg's Nose is a small synclinal basin involving the first Grit and Coal-Measures, coal-seams having been exhausted some time ago: then from a slight lip in the Hollins the solid rock disappears under glacial beds of the Bollin Valley.

The Macclesfield Forest group of hills is in a general way continuous with those lying between Langley and the Dane gorge, so that the whole upland north of the Dane is known as the Cheshire highlands. The continuous nature of this mass and the steepness of its gradients is shown in the fact that no railway has yet been constructed between Macclesfield and Buxton. Within Sheet 110, however, the Langley valley forms a real break, for the uplift is not continuous across it, and there is every reason to suppose that its clay beds conceal another important fault.

The next hill-group shows in an interesting way the effects of erosion upon its component strata. The eastern limb in High Moor (1313 ft.) and Cophurst Edge forms part of a Grit plateau connected eastward with Shutlings low (1658 feet), but while the anticlinal axis may be considered to run through the latter height, the first Grit on High Moor forms a shallow syncline, and at a lower elevation the third Grit forms a strong escarpment in Cophurst Edge facing west. At Hammerton Knowl the third Grit spreads out in another flat-topped height overlooking the Dane Valley.

Below Cophurst Edge beds of shale are encountered, and along these the Rossendale and Shell Brooks have eaten their way until quite a narrow col stands at Clulow Cross (1016 feet). West of this point the grits are replaced by Pendleside crowstones, forming two main upfolds in Bosley Minn (1260 feet) and Sutton Common. Each of these forms an independent pericline, the beds dipping all round at an average of about 20°, the result being two elliptical bosses of the type already indicated. In this group the axes of folding appear to run due north and south, but there is also a south-west to north-east direction seen in Gawsworth Common and Whitemoor Hill, these heights being isolated by faulting in that direction and at right angles to it. The very small effect produced by erosion and severe dislocation on this Sutton Common group is evidence for the solid and resistant nature of the quartzites composing it.

In crossing the Dane Valley southwards we again pass an ancient line of faulting, and the structure has no continuity. The hill-group lying south of the Dane may be called the North Staffordshire moors. It includes two main anticlines oriented north and south in Gun Hill (1223 feet) and

Lask Edge, continuing in High Bent (1102 feet); west of these lies the synclinal Biddulph Valley almost enclosed by a line of scarps in the first and third Grits (see Fig. 6). The Biddulph Basin is better described as a perisyncline. It has formerly been completely shut in on the north, where the third Grit broadens out in Cloud Hill, and provides the most remarkable hill feature in the district, with steep escarpments facing north, east, and west (see Plate I.). The summit is 1190 feet above sea-level, and from this height the ground drops in an almost vertical face to the 600-feet line. Cloud Summit therefore commands remarkably fine views, and its rocks afford some good examples of wind erosion.

The western side of Biddulph Valley is a broken anticline in Mow Cop and Congleton Edge, the orographical axis running north north-east

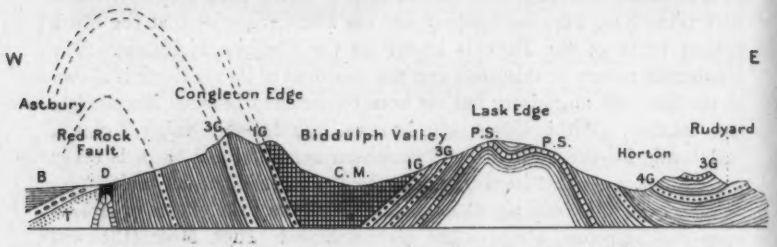


FIG. 6.—SECTION THROUGH ASTBURY AND RUDYARD.

with scarps facing west. Most probably, as suggested above, this Mow Cop anticline was broken up by the Red Rock faulting, in which case the original axis of upfold would run farther west and over the foot of the present ridge (see Fig. 6). This western anticline is further remarkable for the high dip of strata, which in places reaches 70°. With this steep dip-slope on one side and a precipitous scarp on the other, Congleton Edge has a form that fully justifies its title (see Fig. 6). It will be observed in both photo. and section that the Edge is actually formed of a double outcrop of first and third Grits, the third forming the summit.

As one proceeds south-west along its summit, Congleton Edge broadens out into the conical peak of Mow Cop. This widening of the uplift gives it on the contour map the shape of a conch shell: it is due, strangely enough, to faulting on the north-west of Mow Cop, the fault bringing Coal-measures to the surface in place of the Pendleside shales.

It will be seen from the geological map, No. 1, that the Lask Edge uplift involves both Grit and Pendleside strata. The latter are bent into a pericline in High Bent (1102 feet) and Lask Edge (1044 feet), and the narrow neck between these betokens more faulting. Again on the west flank of the anticline both first and third Grits present a series of scarps

(1) GRIT SCARP ON NORTH SIDE OF CLOUD HILL.

(4) RIVER CLIFF IN KEUPER MARL, DANE VALLEY, NEAR SOMERFORD.

PLATE I.

(2) RIVER DANE NEAR HUGBRIDGE.

(3) MEANDERS AND TERRACES OF RIVER DANE AT SOMERFORD.

PLATE II.

facing up the slope, the former being most noticeable in a ruiniform summit called the Wickenstones near Rock End, the latter in Biddulph Moor. The outer shell of grits then continues northward through Biddulph common and Long Edge to Cloud Hill, where it terminates as described above. It seems clear, however, that the shell was once continuous across the Dane valley to the north-east, for there the third and first Grits reappear in Cophurst Edge and High Moor with a reversed dip in the rocks. This is shown in Fig. 7. From the facts there indicated one sees that the core of the structure is a line of Pendleside crowstone hills running through Lask Edge, Bosley Minn and Sutton Common, these owing their existence to separate swellings of laccolite form. As the outer shell of grit diverges from the anticline in a north-western direction to Cloud Hill, one also

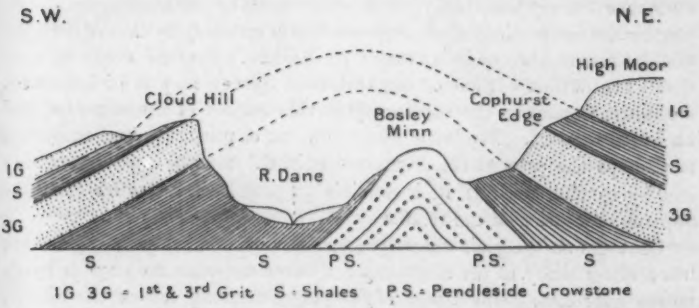


FIG. 7.—DIAGRAMMATIC SECTION THROUGH CLOUD HILL AND HIGH MOOR.

sees that in the latter there is a syntaxis between two different lines of upheaval. This is expressed in the 'Geological Memoir' in the statement that "The radial system of folding which affects the Pottery Coalfield and neighbouring tracts of lower Carboniferous rocks comes to an apex within the area" (*op. cit.*, p. 51), and "that the folds diverge from a point north of the Biddulph valley" (p. 54).

The effect of erosion upon the structure described in this section has been to produce, as already stated, a series of valleys running north and south with the strata (see Fig. 2, *supra*). As a general rule these valleys are synclinal, and have been eroded along the shales: transverse lines, *i.e.* those of the Dane and Langley depressions, are due to faulting. The headwaters of the Trent, however, occupy an anticlinal valley between Biddulph Moor and Cowall Moor, a corresponding position on the opposite limb of the anticline being occupied by the Horton Brook.

It should be noted that practically all the valleys are lined with glacial clays, sand-beds of similar origin being only occasional. Both kinds of deposit reach a considerable elevation along the hill-slopes, suggesting that at the time of their formation "the adjacent valleys were filled by ice up to a level of 1100 or 1200 feet" ('Geological Survey Memoir,' Sheet

110, p. 80). Of special interest are the mounds of sand and gravel at Walkerbarn (1235 feet) east of Macclesfield and at Clulow Cross, south of Cophurst Edge. At the latter spot is a col separating the Rossendale and Shell Brook Valleys: the former of these facing north has been glaciated, the latter has not; whence one readily infers that a tongue of ice was thrust southwards, leaving a terminal moraine at Clulow Cross, but was unable to cross into the southern valley. We must pass, however, to a fuller discussion of the Glacial epoch in the next section.

§ 6. *Glacial Incident and the Cheshire Plain.*

In comparison with the Pennine upland, the remainder of the area appears as a country of low relief and confused topography. The Ordnance Survey map may be studied carefully with reference to its contours, when the immediate impression will certainly be that of irregular undulations and mounds scattered at random. For the study of such detail the outline edition of the Ordnance Survey map is of little use: one must emphasize the superiority in this respect of the engraved and hachured editions. The latter being now out of print, the best substitute is perhaps the present colour-printed edition. By the use of this map and by careful analysis it is possible to produce some order from the apparent confusion of the relief.

Contours on the plain show a comparatively even slope to westward; but a closer study of the modelling convinces one that the slope is by no means unbroken. One traces slight ridges running across the district from south-south-west to north-north-east, *i.e.* roughly parallel to the hill-margin. Such ridges are due neither to rock-structure nor to processes of erosion, for the drainage lines run almost at right angles to them. They are, in fact, results of the occupation of the lowland by an ice-sheet, the whole plain having what is termed a "glacial" or "fluvio-glacial" topography. The latter term is preferable, and will be justified in due course.

The surface deposits of the plain consist of Pleistocene clays, sands and gravels, which are nearly all included under the heading of "drift." That they are originated with the grinding down of rocks under an ice sheet is suggested by the occurrence of striated pebbles, of boulders or "travelled" rocks which are common to hills and plain, and of till or true glacial clay. From a morphological standpoint it seems advisable to distinguish two types of glacial deposit—(*a*) the moundy drift of the eastern plain, and (*b*) the terraced drift of the western parts, which represents what most writers call the outwash or overwash plain.

(*a*) *The Eastern Plain* as far as Peover and Sandbach, *i.e.* to the 200-feet contour, is remarkable for its rounded hummocks, mainly of sand, which frequently occur in clusters or groups. A reference to the geological map (Sheet 110, Drift edition) will show that this is the explanation of the ridge lines referred to above (see Map 1).

Commencing at Gawsworth, which lies 3 miles south-west of Macclesfield, we find hummocks of sand crowded thick round the village, which owes some of its picturesque effects to this fact. From Gawsworth the mounds form a ridge along the west side of the level Dane's Moss, and extending to the limit of Sheet 110. Between Gawsworth and Congleton, the line is much broken by stream action, but again south of Congleton one sees the same capping of sand running through Astbury, Moreton, and Rode Heath to Alsager; the direction therefore is parallel to the hill-foot and the distance from the hills about 1½ miles (see 'Geological Survey Memoir,' p. 97). Farther west a similar line of sands is traceable from Chelford in the north, running due south through Withington Green, broadening out between Swettenham and Brereton, where it is trenched by the Dane Valley, and continuing south-west *viâ* Sandbach, Wheelock, Winterley and Haslington. Certain minor ridges between Gawsworth and Chelford will be referred to later, and in all cases the patches of sand and gravel are found to enclose areas of clay, the latter of glacial origin, but showing by their stratification and shore-lines that they were finally deposited in lakes (see **Map 1**).

Of the glacial lakes of the region, at least six may be distinguished as follows (*vide* 'Geological Survey Memoir,' pp. 88 *sqq.*).

Lake 1 (*Macclesfield*) corresponds to the peat levels of Dane's Moss, but had a larger area than the actual peat-beds, having been held up between the morainic line mentioned above and the foot of the hills at about the 600-feet contour. The enclosing ridge must be regarded as a true terminal moraine of an ice-sheet, the materials having been laid down when the ice for some time remained stationary against the buried Triassic ridge which runs north-westwards to Alderley Edge (see **Map 1**). The lacustrine clays of this lake are traced as far north as Bollington, and there is no reason why the original sheet of water should not have extended in that direction as far as the Mersey. East of Dane's Moss are the river-gravels at the mouth of the Bollin and Rossendale Valleys; as already explained, it seems probable that these were deltaic deposits formed by the two streams on entering the Dane's Moss Lake.

Lake 2 (*Henbury*) farther west is on the site of Henbury Hall and may be called the Henbury Lake. It was at a lower level than the preceding, being bounded by another ridge running west of Henbury Hall, where the Ordnance Survey map shows a summit at 467 feet O.D. Southward this lake extended as far as Lower Pexall, where its clays died out. The clays, however, are bounded by gravel terraces, and Mr. Pocock suggests that the hollow was occupied by "a detached portion of the ice-sheet, which was gradually dissolved away by the stream impinging against it and laying down gravel along its edge" (*op. cit.*, p. 91).

Lake 3 (*Gawsworth*) occupies a hollow south-west of Gawsworth, into which one may suppose the Macclesfield Lake (1) to have been drained by

a connecting stream. Its clays are seen near Shelley Wood and extend as far south as Cheneygate.

Lake 4 (*Capesthorne*) must have been rather more considerable. Eastward it is bounded by the line of mounds from above Henbury Hall to Thorneycroft Hall and Walkerheath, thence east of Tidnock Wood to Cheneygate; its western limit is a similar ridge going south from Astle to Capesthorne Park, then west of Redesmere to Siddington and Marton, while the southern shore in the neighbourhood of Marton is not clearly traced.

Lake 5 (*Astbury*).—Again south of the Dane it seems that the Congleton-Alsager line of mounds held up a sheet of water against the Congleton Edge slopes. As its clay beds run through the Mossley Gap into the Biddulph Basin, the whole of this tract may have been a single lake, though its western bank would then have to be more elevated than at the present day.

Lake 6 (*Brookhouse*) occupied a corresponding position farther west, reaching to the Brereton-Sandbach line of mounds.

Such is the general distribution of lacustrine and moundy deposits which are confined to the eastern half of the Plain country.

(*b*) *The Western Plain.*—Passing to west of Sandbach we find the mounds and gravel ridges dying away, their place being taken by horizontal spreads of clay which is again of lacustrine origin. The transition is really a gradual one, but the geological map clearly shows that clays are the prevailing formation west of Sandbach. Any surface ridges that now occur are narrow and elongated in plan, running west-north-west with the drainage lines: they stand on miniature plateaux or terraces through which the post-glacial streams have carved deep valleys. Thus we have passed from a zone where the ice-sheet left its marginal moraines to one where, in later stages of its northward retreat, it left the whole plain covered with vast sheets of shallow water. It remains to add that any of these clays and sands that are glacial in origin may have been sifted and rearranged by subsequent river action, so that the final grouping is a topography properly described as a "fluvio-glacial complex" (*vide* De Martonne, "Traité de Geogr. Phys.," vol. 2, p. 629).

It is now time to offer a fuller explanation of the glaciation features of the plain, and this will naturally involve some reference to similar phenomena in the Hill country.

Several lines of evidence point to the fact that the ice which occupied northern England in the Pleistocene age was of the nature of an ice-cap similar to the present day 'inlandsis' of Greenland. The fact that we have no traces of local valley-glaciers, that the ice is proved in many cases to have overridden the main watersheds, that in doing that it removed large quantities of erratic blocks from the Scotch or Lake District mountains, and on melting left these stranded along its path right into the English Midlands—these things all point to the existence of extensive ice-caps,

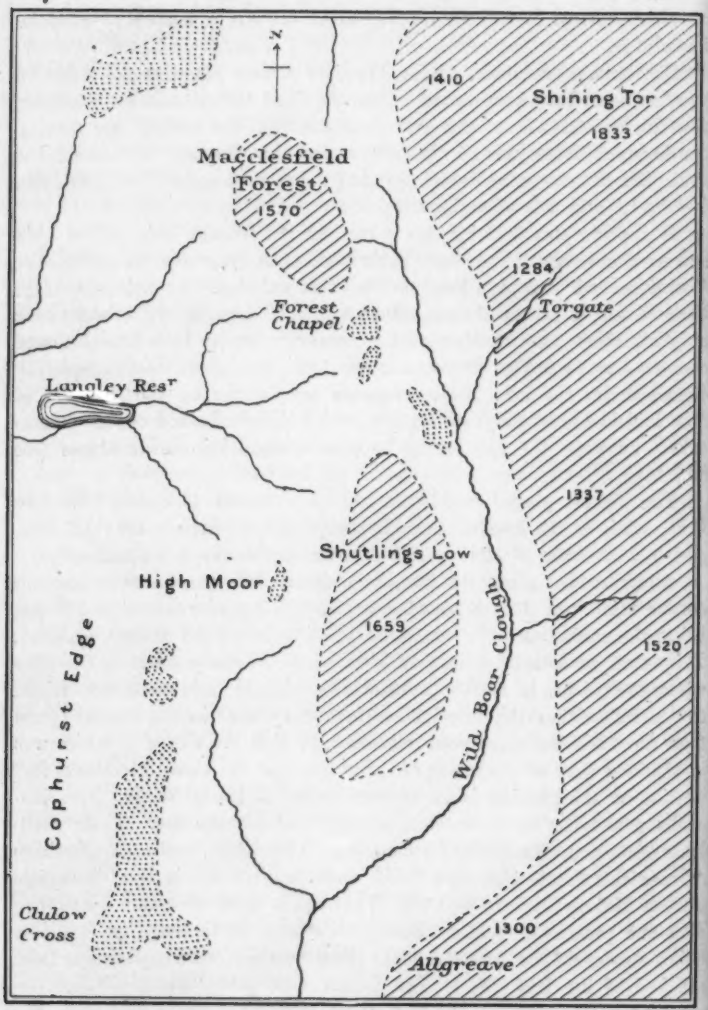
of which several have been distinguished and are a matter of common knowledge.

On the western slopes of the Pennines erratic boulders are either of local origin or have been brought from the Lake District and the Southern Scottish upland. From this one concludes that the ice-cap was moving southward. Other lines of evidence suggest that the same ice crossed the Irish Sea in places, on which account it has been called the "Irish Sea ice-sheet," and will be so described here.

It appears also that ice was thrust up the western side of the hills and even overrode the present watershed, as at Stainmoor in north-west Yorkshire and near Axe Edge in the Buxton area. As pointed out in the 'Geological Survey Memoir,' Sheet 110, p. 80, a group of glacial mounds at Walkerbarn, east of Macclesfield, similarly crosses from one drainage area to another. This does not mean that the upland was completely buried under the ice: glacial deposits are lacking on the summits of Macclesfield Forest and Shutlingslow, which therefore stood out as "nunataks," allowing the flow of ice to pass round their lower slopes (see Fig. 8).

The highest glacial boulder in our area stands at about 1400 feet O.D., while at the foot of the hills the pre-glacial surface is at 317 feet, giving a thickness of 1100 to 1200 feet for the ice-cap at its maximum.

A further consideration of this pre-glacial surface introduces yet another complication. At Sydney near Crewe the drift deposits extend to 320 feet below the surface, or, in other words, 160 feet below the present sea-level. This is an exceptional case, but there must be many parts of Cheshire where the pre-glacial surface is well below sea-level, and one seems driven to conclude either that the land-surface was higher in the Glacial epoch than now, and has since been depressed, or that the site of Cheshire was in that era part of the sea-floor. But perhaps the most interesting fact bearing on the problem is the occurrence in the glacial sands of marine-shells now lying at a considerable height above the sea. These shell-beds occur near Macclesfield cemetery (470 feet O.D.) and at Walkerbarn (Prestwick's Patch, 1200 feet O.D.), and are discussed in the 'Geological Survey Memoir,' pp. 75 and 83. They again raise the same question—Was the pre-glacial land surface so depressed as to leave these places below sea-level? or were the shells lifted to their present positions from the bed of the Irish Sea? The former view—the "Deluge" theory—seems hardly warranted by the whole evidence. When the Irish Sea was occupied by an ice-sheet, the water round its margin may have been sufficient to cover the then existing Cheshire lowland, but this does not apply to elevated spots such as Walkerbarn. Both there and at Moel Tryfaen in Carnarvon glacial sands and rocks have been lifted even above the level of their original source. A valuable summary of the problem by Professor Kendall is quoted in Dr. Wright's 'Man and the Glacial Period,' pp. 137 *sqq*.



Reference

= *Glaciated area*
= *Unglaciated "*
= *High level Drift*

Scale 1:50 000 or 1·27 Inches = 1 Stat Mile

FIG. 8.—GLACIATION OF MACCLESFIELD UPLANDS.

So far the evidence shows that the Irish Sea ice invaded our area from the north and north-west. The difference already noted between the Rossendale and Shell Brook Valleys will afford confirmation of this, for it is the second valley, opening to the south, that has entirely escaped glaciation.

Returning now to the Plain country, the drift deposits already described are shown in section in Fig. 9. The section is taken westward from Macclesfield Forest and Sutton through the sites of the glacial lakes at Dane's Moss and Capesthorne. Two prominent ridges of drift are shown, and it seems probable that the Gawsworth ridge is an actual terminal moraine. Both the ridges, however, have the form usually associated with an "esker," as seen in their ground-plan (see Map 1). Further, the

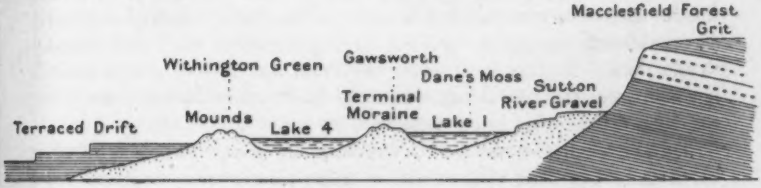


FIG. 9.—DIAGRAMMATIC SECTION OF THE PLAIN.

whole plain is seen to have a network of such lines of sand and gravel. Where these eskers occur in South Sweden it has been suggested that they were laid down by sub-glacial streams which built up embankments, as it were, along which their torrential courses were carried. That is an explanation which may very well apply to the Cheshire ridges; if so, the old glacial channels have now, by inversion of relief, come to form the more elevated parts of the district (cp. De Martonne, 'Geogr. Phys.,' p. 229).

The glaciated area now under review differs from more typical cases, because we assume the Irish Sea ice to have advanced uphill and retreated downhill: in the case of any valley glacier of Alpine type these directions are of course inverted. To be more precise, however, one thinks of the ice-sheet as advancing from the north and being at the same time thrust eastward up the slopes. When its final disappearance set it, the melting presumably began on its southern margin and the main body retreated northwards. On the Pennine slopes, however, we may imagine isolated patches of ice left on the upper parts, and these would retreat uphill. The conditions were therefore such as would naturally break up the ice-sheet in the final stages, which again may account for the double or treble line of drift near Gawsworth.

The Glacial epoch had also some influence on the drainage system of the whole region. This matter is dicussed by Mr. De Rance in the *Staffordshire Sentinel* Summer Number for 1908. He there suggests that the watershed south of Macclesfield, which to-day is crossed by the

Mossley and Rudyard Gaps, was, previous to the ice invasion, a continuous ridge. The ice in its southward advance did not surmount this ridge, as is shown by the limit of glaciation on Cloud Hill (see Maps 1 and 2). As the drainage had now no outflow to the north, marginal streams were originated between the ice-front and the hills, and eventually overflowed southwards at the lowest points in the ridge. Between Rushton and Rudyard erosion must have been remarkably strong, for it has there incised a typical steep-sided trough. Both these valleys are in fact "escape channels" analogous to the gorge on the Severn at Ironbridge. It may be noted that the river Dane probably added its waters during the Ice age to those which followed the Rudyard line, but later resumed its present course westward by Congleton. If the Biddulph Valley had previously drained southwards, as Mr. De Rance thinks, its direction was reversed on the retreat of the ice, for then the escape channel at Mossley was sufficiently lowered for a north-flowing stream to carry this drainage to the Dane. At this point where the Trent and Mersey systems divide it would seem that the struggle has gone in favour of the northern river, the main divide being in continual retreat to the south-east.

On the whole the result of the Pleistocene Ice age had been to fill in the larger inequalities of the relief by lining all the valleys with its thick clays and sands, only adding minor features in the mounds and ridges described above. During that period erosion of the normal type would entirely cease on the plain, whose surface was thus aggraded, and that in places by more than 300 feet of fluvio-glacial deposits. During the actual ice-invasion a temporary base-level was given by the series of lakes lying between 200 and 600 feet above sea-level. The ice having retreated, the base-level was again brought down to the Irish Sea, and rivers were enabled to erode fresh channels across the plateaux of glacial clay. The glacial ridges having a south-west and north-east direction, while the new drainage ran west-north-west, the result is a latticework topography affording considerable variety of hill and dale in low relief. It is this phase of the evolution which is still in progress at the present day, and the immature and ungraded condition of secondary streams on the lowland points to the fact that the relief is there at a more "youthful" stage than in the adjacent upland.

§ 7. Summary of Physiographical Evolution.

It is advisable now to recapitulate in more concise terms the whole physical history of the Macclesfield area. And as the river Dane and its affluents have been the chief agents of erosion, special stress will be laid on their history in thus outlining the physiographical cycles involved. Two such cycles are important, the second being conveniently subdivided as under:—

(1) *Pre-Eocene Cycles.*—The changing land-areas which certainly

succeeded one another in the British region previous to the Tertiary age have little bearing on the present inquiry. The result of an immediately pre-Eocene cycle was to leave the mainland over the north-western portion of the islands, its surface sloping south-eastward from a Donegal upland. The base-level of this cycle was a sea that washed its southern shores, and with reference to that base the Donegal streams eroded their channels. Into this cycle the Dane as we know it did not enter, for no Irish Sea then existed, nor any Pennine watershed for such a west-flowing river. Only the Rudyard line of depression may correspond to a main valley of this first cycle.

(2) *Post-Eocene Cycle.*—The amount of denudation caused in the preceding cycle was not very considerable, for it had only lasted through late Cretaceous and early Eocene times. In the late Eocene comes the renewal of the Pennine uplift, and with it the creation of an Irish Sea depression. The latter, therefore, made possible the initiation of the Dane system, and the steeper slope westward from the Pennines has made it possible for this and similar streams to extend their territory continually at the expense of the older east-flowing rivers.

(2*a*) *The Red Rock Fault Incident.*—One is unable to determine whether the Red Rock fault was created along with the general earth-movement at the beginning of this new cycle or whether it marks a later stage. It is, however, clear that close upon the arching of the Pennine anticlines there followed a foundering of the Cheshire area along the western base, and that area has ever since been a rift depression between two uplands. Where the fault and corresponding scarp crossed the Dane Valley there was a differentiation between the upper and lower sections of the river. The upper Dane, having received a relative uplift, began to eat back from the fault-face into the upper block, thus initiating the narrow gorge in which it enters the district above Hugbridge (see Plate II.). In this incident, therefore, the foot of the fault-scarp is merely a local base-level lying about 500 feet above sea-level.

(2*b*) *The Glaciation Incident.*—Between the last incident and the first appearance of the ice-sheet there had been time for considerable denudation of the upper strata exposed. During the interval we must allow in fact for the removal of the whole succession from the Cretaceous and Jurassic down to the Carboniferous base in some places. The glacial deposits of the Plain conceal, as already related, striking inequalities, and the pre-glacial relief had a system of valleys, as shown by the Sydney section, bearing no relation to the present hydrography of the area.

At the height of the glacial incident the Dane had its western outflow entirely blocked, and must have escaped south by the Rudyard Gap, which it thus helped to create. Then in later stages the glacial lakes of the Plain supplied another local base-level from which erosion was again possible.

(2*c*) *Post-glacial Denudation.*—Only on the final retreat of the ice

were normal conditions resumed. The Irish Sea then became a permanent base-level, and the base having thus dropped some 300 feet while the land-surface had been aggraded by an irregular cover of clays and gravels, the streams received a fresh access of power. In this final episode the Dane in particular excavated its lower valley below Congleton. There we have a pronounced and steep-sided trough, the sides, nearly 100 feet high, being in drift and in the red Keuper marl. Part of this work was probably accomplished before the actual cessation of the Ice age. While incising the main trough in the glacial deposits, the river was of course merely establishing a graded condition for its lower reaches. Only when that had been done could the Dane set to work further to build up on its flood plain the elaborate detail of terraces and meanders which are to-day seen between Congleton and Holmes Chapel. The gravel terraces are traced at three distinct levels, and are most noticeable near Somerford Park, Plates I. (4) and II. (3), where they would probably repay a more careful investigation.

(*To be continued.*)

THE MAP ON THE SCALE 1/1,000,000, COMPILED AT THE ROYAL GEOGRAPHICAL SOCIETY UNDER THE DIRECTION OF THE GENERAL STAFF, 1914–1915.*

DISCUSSION.

The PRESIDENT (before the paper): To some people a map may seem a dull thing, and therefore a dull subject for an evening lecture. There are others who tell us they cannot read poetry. Now I will venture to compare a map to a Japanese poem, which is the concentrated essence of poetry. To a Japanese poem the reader is expected to bring a responsive and appreciative mind, so that he finds in its very few lines enough to excite in him all sorts of suggestions, trains of thought, or recollections. So it ought to be with a map when it falls into the right hands. We have all, I suppose, read Stevenson, and most of us remember how his imagination revelled in a map, and how much romance he could evolve out of one. I believe even the average man, the ordinary traveller, one of ourselves, can derive much, not only anticipatory pleasure but practical profit, from a map. I know that in 1868, on an indifferent map on quite a small scale of the Caucasus, I was able to lay out a scheme for the exploration of the mountains, and my route, though entirely condemned by the best local authorities at Tiflis at the time, was carried out in its entirety, and I do not think I could invent a much better one at the present day. At a later date when the Russian Staff maps of that country became available, what mystery there was in the great green expanses that indicated pathless forest tracts, or in the vague smears that suggested virgin snows and ice-fields; and then what an invitation—more than an invitation, a challenge—was conveyed by the entry on Sir Joseph Hooker's map to the north of Kangchenjunga: "This country is said to present a very elevated rugged tract of lofty mountains, uninhabitable by men or animals." How often with most of

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* Continued from the *Geographical Journal*, July, 1915, p. 50. Royal Geographical Society, June 28, 1915.

us a map has recalled in after years memories of past adventure and cherished visions of the glories of the world! If a map can mean so much to the traveller and geographer, if even its imperfections may act as stimulants, how much more ought it to mean to the soldier, the strategist, and the statesman! I am afraid our history is unfortunately full, down even to the date of the Boer war, of the consequences of the absence or the neglect of maps. Now we are improving; our maps are better, and we know better how to use them. We can print in many colours, without sacrificing scientific accuracy. Contouring has been elaborated, though contours are still to many educated people a mystery. Physical features and roads are shown and distinguished, so that he who runs, or, I should better say, motors, can read. Nothing perhaps has done so much to spread the power of rapid map-reading as the rise of motoring. It is admirable practice to have to steer your way through a new, strange, and intricate country by the use of the map. Therefore, if the subject of our discourse to-night is more technical than is usual, I trust it may not prove unattractive. What Mr. Hinks is proposing to give us is some idea of the principles on which a new map of Europe on the scale of 1 : 1,000,000 has been constructed on our premises for the use of the War Office. I had occasion to point out at our annual meeting that this map has employed, under Mr. Hinks's superintendence, much of the energy of a staff reduced by the war, and also of a large number of volunteer workers, many of whom were ladies. You may some of you remember that several years ago, in 1909, a conference held in London, under the auspices of our Government, resolved that steps should be taken to produce a uniform map of the world on this scale. As was perhaps to be expected, considering the number of governments and agencies engaged, the progress made with the scheme was slow even in Europe, and in some ways unequal. When the war broke out last year relatively little had been accomplished. I shall now call on Mr. Hinks to tell us what has been done during the last nine months, and I will ask him at once to read his paper.

Colonel W. C. Hedley, R.E. (Chief of the Geographical Section, General Staff): I am glad of this opportunity of saying how much the War Office appreciated the action of our President in putting all the resources of the Society at the disposal of the War Office on the outbreak of war. We of the G.S.G.S. were not slow to avail ourselves of the offer, and from the beginning of August up to the present time the work of this Society on behalf of the Geographical Section of the War Office has been continuous. The 1/M map was not the first work, though perhaps the most important. A number of indexes prepared by the Society have been of the greatest possible use during the course of the war.

We would never have ventured to suggest that the Society should undertake the heavy task of compiling a 1/M map of Europe, but gladly accepted the offer, and we, on our part, undertook to arrange for the publication of any sheets that might be compiled. We did not quite realize the full extent of the zeal of the Society. We had contemplated a block of the nine central sheets of Europe, but the continent of Europe did not provide sufficient scope for the energies of the Society, and not only have the compilers overflowed into Asia, but the Secretary has even thrown out hints of Africa.

It is easy to understand the value of a general map which clearly depicts the topographical features and the political boundaries on a scale which is sufficient, but which is not so large as to make a general view impossible. We are constantly asked for such maps of all the present or probable theatres of war, and we have often wished that the International 1/M map had been an accomplished fact, and that a large stock of each sheet lay in our map stores. That wish is now in a fair way to fulfilment owing to the work of this Society. When that is the case we shall

be able to make up a map of any area required, for, as Mr. Hinks has shown, any number of sheets up to nine can be conveniently mounted as one map.

We found ourselves in complete agreement with Mr. Hinks as to the general principles on which the map should be compiled. The projection and conventional signs were to be generally those adopted by the Paris conference, and the map was not to be so overcrowded with names as to obscure the topographical features. Having got so far, we, at the War Office, recognized the fact that the compilation was in most competent hands, and that a large amount of work was being devoted to it. An effective criticism of such work would have demanded more time than was at our disposal, and we left complete liberty of action to the compilers. In this sense I agree with Mr. Hinks that he has been fortunate in the department under whose nominal guidance he has worked.

Mr. Hinks has explained how the map had to be rapidly compiled. The same condition attached to the reproduction, and it has not been possible to use those slow and deliberate processes which can alone do real justice to small-scale maps. A very clear and useful map has, however, been produced.

It is impossible to secure complete agreement with respect to all the details of any map, as nobody would deny who took part in the Paris conference. In this respect Mr. Hinks and I were singularly fortunate, but in one or two points we differed. I do not myself think that the Paris conference ever contemplated the omission of country and provincial names from the face of the map, nor do I see any particular difficulty in arranging them satisfactorily over a series of sheets, but we have deferred to Mr. Hinks's wishes in this matter so far as Europe is concerned. In Asia there is no difficulty at all in showing boundaries in black, which I myself prefer, or in including all names on the body of the map. We do not, however, think it necessary to write "Turkey in Asia" right across the sheets.

As regards other details, I have nothing to add to what Mr. Hinks has said, but I would like to refer to one point. The Turkish experts, on whom we at the War Office rely, disapprove of the use of "dj" for the English "j," and on previous War Office maps of Turkey we have used the simple "j," but for a map on the International system, and including so wide an area, I have been convinced that the "dj" is justified.

I am very grateful to Mr. Hinks for his lecture. I feel sure that it will lead many of our fellows to take an interest in the map, and that the map, as explained by his lecture, will add to their geographical knowledge, in addition to being of great use in the present crisis.

Colonel C. F. Close: The lecturer to-night mentioned a certain dinner. This was suggested by Dr. Keltie. Dr. Keltie told me, when we were at Geneva in 1908, that the American delegates had come with a proposal to standardize the International Map, and proposed that we should collect those interested in the subject and give them a dinner. We gave them a dinner, and as a result the International Map took its present shape. In the interesting account which Mr. Hinks gave us, I think he rather indicated that the progress of the International Map was not quite what might have been expected. I wish to remove that impression. The progress has been quite satisfactory. If you consider, we began first of all with an International Geographical Congress in 1908; then there was the International Congress in London in 1909; then the Rome Congress of March, 1913; and after that, an International Official Conference in Paris in December, 1913: I am sure that no one here will wonder, who knows the difficulty of working these organizations, that the scheme did not move more quickly. As representing the Central Bureau of the International Map I can tell you that twenty-eight States have already joined this organization. Of course this

great war puts everything in the background, and we shall not expect any progress in Europe, Africa, or Asia in the International Map, of any value, until the war is over. It is, however, still very much alive, and we have not been listening to a funeral oration. I am perfectly certain myself that when the war is over all civilized countries will be very ready to push forward this great scheme of mapping the world.

I feel that I ought to say quite definitely, as the President for the time being of the Central Bureau of the International Map, that this map described by Mr. Hinks is not the International Map. It is only an offspring from it, and may be a useful adjunct, but it is not the International Map. The International Map is a more authoritative production, and differs from this effort in form and intention, in character and in detail. The map that we are discussing to-night has a National and not an International character.

As regards the scale of 1 : 1,000,000, all of us are not familiar with such large numbers, and perhaps, as illustrating the difficulty which some people find in appreciating the number 1 : 1,000,000, I may tell a small story. In 1902 I went to Jersey to make a map. When I got there an officer said to me, "There are miles and miles of roads in this island—7000 miles of roads." (As a matter of fact, there are about 350 miles.) A little time afterwards I saw this officer again, and he said, "How many miles of road did I tell you there were?" I said, "You said seven thousand." "Oh!" he said, "that's all right. I thought I had said seven millions."

Captain Lyons: I have listened to this lecture of Mr. Hinks with the very greatest pleasure. I have had no previous opportunity of seeing the work that has been carried on in the Society's house during these past months, and therefore all that has been put to us so well and clearly as Mr. Hinks has done has been both new and attractive. But besides that, I really think he has opened up a new chapter in British cartography. We certainly have no such clear and careful record of a large piece of map compilation as Mr. Hinks has shown us this evening, and I anticipate that out of this, especially when we are able to read it in the *Journal*, a very greatly increased interest in scientific cartography will grow up among British geographers. I am strongly of opinion that we British geographers needed such an incentive to go more seriously and more carefully into the problems of cartography. I must thank Mr. Hinks very much for having placed us in this position, and given us this large amount of valuable material to work upon, and to free ourselves from the empirical methods of compilation which have been too much followed.

Mr. D. G. Hogarth: The only thing I have to say is that anybody who compiles a map of this kind must be prepared for criticism. He gives any number of openings to it. Take that question of names alone. It has been said there are not enough names. What conceivable principle can you go on about names? In that part of the area which I was asked to revise, Greece, the only guide which could be taken was the official census, and the names which were inserted were those of the principal towns of each particular little province; but these, of course, are totally inconsistent with scale of size, as adopted in another part of the map. If you were to apply this scale of size, you would not have a single name in Northern Greece. For there is hardly a town of 10,000 inhabitants in the whole country. Most of those places which actually appear are, as a matter of fact, villages of one street, one or two cafés, a school, and a Government centre. Therefore, I hope people who do criticize these maps will remember that nothing is so easy to criticize, and nothing so impossible as to attain consistency. Upon two sides of a frontier in the same sheet you have to adopt absolutely inconsistent systems of

transliteration. I hope those who wish to criticize these maps will devote their critical power to other questions than those which the selection or the spelling of the names will present. Opinions will always differ; for instance, the opinion of the bookseller who wants every possible name and Mr. Hinks' principle, which is that the names on the whole must be subordinated to the physical features. Nobody will use this map as a means of finding every possible name, or even one name in ten. But it ought to give us a much better idea than we have been able to attain hitherto of the general lie of the country and of the distances which have been, and still have to be, traversed by the different armies going to and fro.

Captain B. F. E. KEELING: I do not think that I have anything very much to say on the subject of this map. I came home from Egypt in January, and I was very glad to find some work to do under Mr. Hinks while I was waiting for a definite job. Mr. Hinks turned me at once on to making a map of Turkey. I have never been in Turkey, and when I started making the map I did not know a word of Turkish, but I was asked to look into the question of names, and make the transliteration of these names more or less consistent. It was not very easy as I knew no Turkish, but the sort of direction in which that particular subject was tackled was as follows: Turkish contains a great number of Arabic words. The script is very similar. Most of the letters (all but three) are the same letters in Turkish and Arabic, and the plan we adopted was to make the maps of Turkey as far as possible uniform in principle with the maps with which I was more familiar, the maps of the Egyptian Survey Department, and I think on the whole we have got the consonants of Turkish more or less consistent and pronounceable by anybody who can pronounce the names on an Egyptian map. It is some months since I was on this work, and since then I have been, under Colonel Close, in charge of the reproduction of a good many of these maps, and this has been in many ways as interesting as the compilation, to a man who had not previously been particularly in charge of such work.

Captain MACLEOD: I have very little to add. There is one point I might draw attention to. You may not have all gathered from the lecture the very dominating part which Mr. Hinks himself took in the preparation of this map. It is inevitable, as he is the lecturer, that he should have said very little of his own share in the work; but I think he has brought out in his lecture the great number of problems which arose in the course of compilation. He has only touched upon some of them, and I think he has pointed out very clearly how difficult it must have been to deal with them. I worked on this map for some time, and I can assure you the number of conundrums with which he was bombarded was prodigious, only to be equalled by his extraordinary skill of answering—or evading them. Nobody without his very remarkable geographical knowledge and grasp of the subject could possibly have done it. I frequently used to come out with some conundrum which I thought would really "floor" him, but somehow he generally managed to rout me. I went away satisfied, at any rate.

The PRESIDENT: I think the time has now come when I ought to wind up the proceedings. We have had a very excellent paper, and a business-like and instructive discussion on it from some of the experts who have taken part in the map. If there is any room for criticism, it might be that we have paid throughout the evening a disproportionate share of attention to the names to be put on the map, and the ways of spelling them. We have left ourselves no time to discuss the method of representation of hills, the system of contouring adopted, or the distinction in the matter of roads, all of them very important details in a map of this character. I am afraid I am going rather to add to than to diminish this disproportion, because the question of names is one that appeals to me personally. I have

had to do with the cartography of the Russian Caucasus where place-names originally Turkish have passed into Russian, and then in many cases been familiarized in Western Europe through German channels. You therefore have to decide whether, while adopting our Society's system of spelling, you will treat them as Russian names, or as Turkish, and you also have to get rid of the German taint. With this experience I can fully sympathize with the difficulties which have been felt by our map-makers. What the practical traveller desires is that the name printed in the map shall, as he pronounces it, be intelligible to the people of the country he is exploring. If it is not that, it is apt to land him in great difficulties. I sincerely trust that the names on our new map may serve their purpose. The map has been a great undertaking, and the Society are much indebted to their new Secretary for the energy he has thrown into this extra work, and not only to him, but also to our own Staff, who, though in a reduced condition, have co-operated very loyally and worked very hard, and to the numerous assistants already mentioned who have come in and worked for weeks from nine in the morning to eight at night in order to get on with this map and other previous work wanted by the War Office. I think you will all agree in voting very heartily our thanks to Mr. Hinks for his lecture and for the work which it represents.

REVIEWS.

EUROPE.

Bristol and Neighbourhood.

'La Région de Bristol.' By [Miss] E. M. Sanders. (Thèse présenté à la Faculté des Sciences de Paris.) Paris: Jouve et Cie. 1914. 3*s.* 6*d.*

In this interesting and well-written thesis presented by Miss E. M. Sanders for the degree of D.Sc. of the University of Paris the authoress throws some light upon various problems in the geography of the Bristol region. She successfully demonstrates by the application of a purely geographical method that the combes of the Mendips and other limestone plateaus of the region have not been formed by the collapse of a series of caverns as generally believed, but are really due to superficial fluvial activity during two successive cycles of erosion. With regard to the history of the Bristol Avon she presents an hypothesis which is a variant of Jukes Browne's theory of its obsequent character. She suggests that the Wye was originally continued across the line of the Severn by way of the Trym and its gorge at Henbury into the Avon below Clifton, and that the ancient river then flowed along the present line of the Avon, but in the opposite direction through the Jurassic escarpment to join the Thames. In the stage of senility the upper portion of this river was captured by the Severn, and the middle portion by a tributary of the Severn which worked backwards from Avonmouth to Clifton and then reversed the flow of the Avon. This hypothesis, however, neither excludes nor is greatly preferable to that of Jukes Browne. Interesting chapters deal with the evolution of the Bristol Channel and the human geography of the region. The thesis is amply illustrated with maps, sketches, and block diagrams, and might well serve as a model for similar university work.

J. D. F.

ASIA.

A French Voyage to the Far East, 1817–18.

'La Mission de la *Cybèle* en Extrême Orient, 1817–1818.' Paris: Champion. 1914.

This voyage, under Captain de Kergarion who was twice taken prisoner in naval engagements with the British during the war with France, took place soon after the peace which followed Waterloo. Captain de Kergarion was appointed to the command of the frigate *Cybele* in 1814. He started from Brest for the China Seas on March 16, 1817, and the present narrative consists of his description of the various places at which he touched, which included Malacca, Manila (where he fell in with the H.E.I.C. corvettes *Discovery* and *Investigation*), Macar, and Hainan, to which important island a large part of the narrative is devoted. On her return the *Cybele* called at various points along the Annamese coast, and came home by way of Pondicherry, Mauritius, Bourbon, the Cape of Good Hope, and St. Helena, arriving at Brest on October 18, 1818, after eighteen months' cruise, in the course of which various valuable surveys were made and useful information was acquired.

AFRICA.

Ibibio Women of Nigeria.

'Woman's Mysteries of a Primitive People.' By D. Amaury Talbot. Cassell & Co., Ltd. 1915. 10*s.* 6*d. net.*

The story which Mrs. Talbot has to tell of the lives and beliefs of the Ibibio women of Southern Nigeria is one which cannot fail to arouse considerable interest and no little eagerness to know more. There are almost bound to be aspects of native life which can only be elicited from the women by one of their own sex, and Mrs. Talbot, realizing the importance of such work, set herself to find out all that she could about the women in the areas where her husband held office. In this part of West Africa there are indications that women formerly held a far higher position than at present; indeed, the famous Egbo society is said to have been originally a feminine institution until perfidious males wrested the mysteries from the weaker sex and proceeded to exclude them therefrom. This furnishes a parallel to certain myths current in different parts of New Guinea as to the mysterious bull-roarer having been first discovered by a woman, though subsequently no woman might see the sacred object under pain of death. The author describes the preparation of maidens in the fatting-house for marriage, magical devices for ensuring fertility, love-potions and methods of setting aside rivals, funeral rites and were-beliefs, the odium attaching to twins (which is so great as to necessitate the mother's spending a whole year of purification in a twin town), women societies, and rites which no man may witness. An excellent method is adopted of illustrating customs and beliefs by quoting native tales and giving brief reports of cases which came before Mr. Talbot. The beliefs about conception seem to vary. On page 12 we are told that the belief of Ibibio women as to the origin of their infants' souls "is much the same as that of the Central Australians," as "is clearly shown by the action of bereaved parents who . . . bring curls clipped from the heads of dead babes, to be placed in a hole in the rock, dedicated to Eka Abassi . . . praying that she will speedily set the feet of their little ones upon the road back to life. In the sacred fish, too, with which all holy pools and streams abound, the souls of dead ancestors are thought to dwell, waiting for reincarnation." On page 49 we read of a "baboon soul" (*i.e.* the ghost of a man

belonging to this totem, who had been in the habit of assuming this were-shape), which had awaited reincarnation close by the sacred pool, being born again in the child of a woman who had come to the pool to pray for offspring. Again, there is a special juju, Isemin, which bestows fertility on the woman (according to one informant by entering them) as they go naked in procession to bathe in one of his pools at the new yam festival. Mrs. Talbot makes no claim to write a scientific treatise, and she has not attempted to sift what may appear at first sight to be conflicting evidence. She has set out to give a thoroughly readable account of what a keen, cultured and sympathetic observer could learn from the women among whom she lived, and on the fulfilment of this task we heartily congratulate her. There are forty-four excellent plates from photographs.

Abyssinia from an Italian Standpoint.

'Nella Terra dei Negus, pagina raccolta in Abissinia.' By Dr. Lincoln de Castro. 2 vols. Milano: Fratelli Treva. 1915.

In these two volumes Dr. de Castro has recorded at considerable length his experiences of Abyssinia, where he appears to have resided for several years; but an awkward absence of dates makes it difficult to understand exactly what period the general information relates to, although one gathers that the author's return to his native country was quite recent. His outward route was from Naples, through the Canal to Massaua, and thence to Assab and past Perim to Aden, where there is an easy and frequent means of transit to the port of Zeila, on the African mainland, in British Somaliland. The details of the journey from the sea to Addis Ababa, the Abyssinian capital (the general bearing of which is from north-east to south-west), occupy 66 pages, an interesting portion of which treats of Harrar, which at the time of the author's visit was occupied by the well-known chief Ras Makonnen. This Abyssinian dignitary visited Europe, and was well received both at the Italian and British courts. Other chapters of the work treat of the history of the country from earliest times down to the present day. The capital Addis Ababa is exhaustively described, and several particulars are given of the Franco-Ethiopian railway, which starts from the port of Jibuti, and, according to the most recent information at hand, ought by this time to be practically complete as far as the capital. The second volume is taken up with the natural resources of the country, the fauna and the flora, the manners and customs, language and literature, laws and religion, while separate chapters deal with the topography, routes, and chief towns, and include a detailed discussion of the ethnology of the Ethiopian plateau. One of the chief features of Dr. de Castro's work is the remarkable collection of photographic illustrations, 367 in number. These are excellently reproduced, and the variety and judicious selection of subjects show considerable taste and appreciation. The landscapes are in many cases remarkably picturesque and pleasing. The towns and dwellings are in most cases uninteresting owing to the rough and primitive style of architecture; an exception may, however, be made in the case of the castles of Gondar, the ancient capital, which are characterized by a specially interesting style of their own dating from the early part of the seventeenth century. The fact that the two volumes cover nearly a thousand closely printed pages indicates to some extent the amount of information so laboriously collected by the author.

Pioneering in Katanga.

'Adventures in Africa under the British, Belgian, and Portuguese Flags.' By J. B. Thornhill. *Map, Diagrams, Index, and Glossary.* London: John Murray. 1915. 10*s.* 6*d. net.*

It would be difficult to find a better, or as good an account of what pioneering in South Central Africa means, as we have in this book, which describes the part played by the author and others in the opening up of Katanga. Mr. Thornhill, who had already some years' experience in Rhodesia and other regions of South Africa, went to Katanga in 1905. The development of its resources by the Tanganyika Concessions company had already begun, but much remained to be done. A new country attracts men of many types, and of these types the author gives us life-like sketches. We also obtain a clear idea of the character of the land. Much of it Mr. Thornhill mapped, and we should have been glad of a more detailed map than that here furnished, which is not, moreover, brought up to date in respect to railway construction. Geographer, geologist, road-maker and bridge-builder, draughtsman, sportsman, and cattle-man, the author turned his hand to any job, and he tells of his work in a manner which enables us to grasp what pioneering really means. He shows, too, the difficulties which beset "the small man" in a country such as Katanga, where the ruling companies monopolize practically every industry. His book in fact constitutes one of the most powerful indictments of the concessions system we have read. To what he believes to have been the thoroughly vicious economic *régime* of Leopold II., Mr. Thornhill attributes the evils that marked the former Congo administration. Writing with knowledge and from personal experiences the author declares that the condition of Angola under the Portuguese was far worse than the condition of the Congo under Leopold II. (Slave raiding by the Portuguese has, we believe, stopped since Mr. Thornhill left Katanga in 1908.)

It is well known, to those interested, that Sir Alfred Sharpe and others tried to add Katanga to the British Empire. Mr. Thornhill gives a piquant version of the method, a piece of very rough "pioneering," by which Captain Stairs secured the country for Leopold II., as to which Mr. Maloney's account of the Stairs expedition may be profitably consulted. Mr. Thornhill also throws a little light on later proposals to "jump" Katanga by interests opposed to the Congo State. He rightly lays stress on the ideal character of the region of the Congo-Zambezi watershed as a grazing area. The wealth of Katanga in minerals should not lead to the neglect of its pastoral capabilities.

An appreciable part of the volume is devoted to the native races and to hunting stories. Mr. Thornhill tells of his sporting experiences in a fascinating manner—a welcome relief from the usual dull tale of slaughter by the man who goes out solely to shoot big game. We may note that Mr. Thornhill spent six years in lion country before he saw a lion, and that the only living creatures he appears to dread are hornets. Lions he regards as vermin. Acquainted with various Bantu languages, the author has much to tell worth knowing about the natives. His views may be described as primitive and as lacking in appreciation of missionary and civilizing enterprise. He makes few generalizations: we quote the most striking: "To my mind they [the Zulu] are the finest race, physically and morally, in the world, the men fearless and honourable, the women workers and virtuous."

As far as he was able Mr. Thornhill traced the watershed between the Congo and Zambezi basins, and it would be interesting to know how far his rough survey

agreed with that of the recent Boundary Commission. Incidentally we learn that the author regards the Lualaba, and not the Luapula, as the true "infant Congo." As the Boundary Commission found that the Luapula did not issue from Bangweulu, but is a continuation of the Chambezi, that stream would appear the most imposing of the headwaters of the Congo. For a keen geographer Mr. Thornhill makes one curious mistake. References to Uganda as a white man's country are puzzling until, near the end of the book, we find he locates Nairobi in Uganda.

We have dealt with the book from the African standpoint, but its value transcends locality. Consciously or unconsciously the author reveals himself to the reader—and his is a vivid and arresting personality. Mr. Thornhill goes straight to the heart of things, and many besides those interested in South Central Africa will find delight in his pages.

F. R. C.

AMERICA.

Immigration into the United States.

'The Old World in the New.' The significance of past and present immigration to the American people. By E. A. Ross. Pp. 327. *Many Photographs.* T. Fisher Unwin. 10*s.*

Mr. Ross, who is professor of sociology in the University of Wisconsin, provides the key to his book in the preface by his comment on the words of a large-hearted American woman engaged in settlement work. "Think what American chances mean to these poor people! Thousands make shipwreck, . . . but tens of thousands do realize something of the better, larger life they had dreamed of." This sentiment forced the reply, "Her sympathy with the visible alien at the gate was so keen that she had no feeling for the invisible children of *our* poor, who will find the chances gone, nor for those at the gate of the To-be, who might have been born, but will not be. I am not of those who consider humanity and forget the nation, who pity the living but not the unborn."

Through many pages Mr. Ross deals with the immigrants both as regards chronological order and place of origin, and shows that the character of the invaders has steadily changed from the "choice grain sifted from a whole nation," who were the pioneers, to the backward races from Central and Southern Europe, who are tempted to the new world at the present time by the envoy of the steamship company which is eager for dividends, who serves as a man-catcher for the basic industries of America, in order that the "bosses" may make millions.

The descriptions of the several races of immigrants depict the situation of each with force and thoroughness, and the general view is enforced by distribution maps, photographs, and chronological diagrams. The Italians, for example, are incapable of ordinary extensive American farming; they consequently engage in market gardening, and "drift round and round in a 'Little Italy' eddy." The superfecund Central Europeans push out the descendants of previous emigrants, and Mr. Ross suggests that only "the invasion of the labor market by hordes of still cheaper Asiatics" will cause the Slavs and Italians to lose interest in America.

Peonage is Mr. Ross's name for the economic slavery of the American mines. American miners earning $2.75 a day are abruptly displaced by raw Italians from the steerage who earn $1.50 to $2 a day; these become more decent in their habits, ask for more wages, and in turn follow the American miners "down the road." The estimate of the number of floating casual labourers ranges up to five millions.

After pointing out other results of the immigration of low-pressure peoples

into a high-pressure state, such as the failure of wages to advance at the same rate as the cost of living, Mr. Ross refers in scathing terms to the ideas which underlie the sterility of the native-born Americans. This book will be useful to all students of economic geography, as it supplies a view of the results upon the human race of one phase of man's conquest of nature.

B. C. W.

Early Enterprise in Guiana.

'A Walloon Family in America. Lockwood de Forest and his Forbears, 1500–1848. Together with a Voyage to Guiana, being the Journal of Jesse de Forest and his Colonists, 1623–1625.' By Mrs. Robert W. de Forest. *Illustrations, Maps, Index.* 2 vols. Boston and New York: Houghton Mifflin Company. 1914.

This is mainly the chronicle, interesting enough in its way, of a Walloon family, which towards the middle of the seventeenth century migrated to the then New World of America, where from time to time one De Forest or another did excellent pioneer service; but by far the most interesting and valuable part of the book, at least to British geographers, is the journal, here printed practically for the first time, of one of the earliest attempts to settle in Guiana, in which a member of this family, Jesse de Forest, took a prominent part.

Jesse de Forest, born in 1576 at Avesnes, in the Walloon province of Hainaut, had removed in 1615 to Leyden, where he became a burgher and a dyer by trade. Before long, partly because more children were born to him than he could support, and partly because he was of the unpopular reformed religion, he became anxious to lead a party of his fellow-burghers and co-religionists to a new and freer home in the "West Indies," which to him meant any of the then known parts of America. After several abortive attempts to carry out this scheme, Jesse in 1623 persuaded the Directors of the then newly-formed Dutch West India Company to give him, and ten other "fathers of families," passage in the company's 90-ton trading ship *Pigeon* to the "Wild Coast," *i.e.* to Guiana, where they were to select a place suitable for settlement to which their families might follow.

The *Pigeon*, with Pieter Fredericsz of Harlem as master, left Amsterdam on July 2, 1623, and after fifty days reached the mouth of the Amazon river, where some six weeks were spent by the master of the *Pigeon* in trading with the few English and Irish who were already settled thereabout, while the fathers of families, under Captain Jesse, looked for a site proper for the intended colony. But, partly for fear of the Spaniards, who were reported to be not far off, no suitable site was there found.

Then the *Pigeon* followed the coast upwards, calling in at the many river mouths, to trade with the Indians or with the few settlers from Europe, the Walloon passengers meanwhile using every opportunity to look about for a site.

At last, near the mouth of the Wyapoko river, at a place called Commaribo, they found a place to which, as they told the master, they wished to bring their families. Thereupon the master disclosed that he had orders from his Directors to leave all but two of the fathers at the chosen spot, to which their families would be sent from Holland. "This astonished several of them, who began in divers ways to excuse themselves"; but Jesse de Forest was willing to remain if he might have "in place of the heads of the families who wished to return (to Holland) the same number of sailors." Accordingly Jesse de Forest, Louis le Maire (a near relation, perhaps a brother, of the discoverer of the Straits of Le Maire), and a third Walloon father remained, together with the gunner, four sailors, and the surgeon's mate—nine persons in all. This was arranged on December 27, and on January 1, 1624, the *Pigeon* sailed for Holland.

As long as De Forest lived the new settlement flourished; but this very energetic and able leader died of sunstroke on October 22. Thereafter things went so wrong, and hope of the arrival of a relief ship grew so faint, that the survivors decided to build a boat and so escape. But before this boat was quite complete, another Dutch ship, the *Flying Dragon*, arriving on May 23, 1625, and the master, Gelyn van Stapels of Flushing, "told us (says the writer of the journal) that he was charged by the Directors of the West India Company . . . to take us with him, which gave us great joy."

The *Flying Dragon*, with the rescued colonists on board, tracked along the whole coast from the Oyapok to the Essequibo, thus enabling one of the Walloon fathers to complete the account of the 'Wild Coast.' At the mouth of the Essequibo, some 40 miles up which river the Dutchman Captain Gromweagle had, nine or ten years previously, established the settlement of Kykoveral (the nucleus of the present colony of British Guiana), the refugees were transferred to another company's ship, the *Black Eagle*, which brought them safely home to Flushing on November 16, 1625.

It is probable, as is suggested in the book under notice, that the first part of the "Journal du voyage faict par les pères de familles," is a copy of the diary kept by Captain Jesse de Forest, and continued after the captain's death by Jean Mousnier de la Montagne, one of the three Walloons who were left by the *Pigeon* at the Wyapok. The MS. came in some way into the possession of Sir Hans Sloane, and passed with his collections to the British Museum, where it was not scrutinized till some twenty years ago; in the search for documents for use in the Anglo-Venezuelan Arbitration case its nature was recognized, and its value as the earliest account of the geography of the Wild Coast of Guiana, written at a time when European settlement in those parts was only beginning. Fragments of the journal were printed in the Appendix to the British case (vol. 1, p. 59); but Mrs. Robert de Forest has now given us the whole of the text of the actual journal, in the original French and in an adequate translation. It seems ungracious, but it is impossible not to wish that she had done just a little more, and had given us the whole of the nine maps (which form a valuable part of the original) instead of only four, and had given the ten descriptions of rivers instead of only two.

E. im T.

'Seven Years on the Pacific Slope.' By Mrs. Hugh Fraser and Hugh C. Fraser. (London: T. Werner Laurie. Pp. xii., 391. *Illustrations.* 12*s.* 6*d. net.*) A sister of the late Mr. Marion Crawford and the widow of a former British Minister to Japan, Mrs. Fraser has literary gifts which she has variously turned to account. In geographical circles she is perhaps best known for her 'Reminiscences of a Diplomatist's Life in Japan.' The present book, in the production of which she has had the aid of a son, is the fruit of residence in a remote corner of the State of Washington. It is a description of the conditions of life in a raw Western settlement, by means of literary sketches in which the personal element is dominant. Presumably these sketches have been published separately; in two successive chapters different descriptions are given of the same fire. Mrs. Fraser holds decided views and is not afraid of expressing them. Underlying much surface praise is a strong current of criticism, and the book, written in a lively style, not only amuses but stimulates thought.

'Argentina' and 'Chile.' By G. J. Mills. (London: Sir Isaac Pitman & Sons. 1914. *Maps and Illustrations.* Each 6*s. net.*) These two volumes

belong to the series of "South American Handbooks" of which the first four volumes were noticed in the *Journal* last January (vol. 45, p. 71). They conform closely to the general plan of the series there described and are welcome as handy works of reference. Mr. W. H. Koebel contributes a lengthy preface to each of the new volumes.

GENERAL.

The British Empire.

'The British Empire: Six Lectures.' By Sir Charles P. Lucas. London: Macmillan. 1915. Pp. 250. *Maps.* 2*s.*

Those who were privileged to hear these lectures should be glad to possess them in a permanent form; those who did not hear them may read them as an admirable literary effort unspoiled by having been first spoken. Their sequence is historical. The first deals with the making of England, carrying the story from the period of that other empire which alone is comparable with ours, down to the beginnings of our own empire-building. The seventeenth and eighteenth centuries each form the subject of a lecture; the age of Queen Victoria follows; and the two final discourses on the empire at the present day, and on its "meaning and use," are the most interesting and impressive of the series. In these especially the author is at pains to indicate the geographical influences which have been and are at work—influences of environment, influences affecting communications, and the like. Of the importance to the empire of modern developments in methods of communication—the transport whether of messages, of merchandise, or of men—the author has before treated elsewhere: he rates very highly the advances of science in these departments as factors in imperial expansion and consolidation. In the last lecture but one we are given a masterly survey of the "immense range of area and climate," included in the empire, and the consequent range of products and diversity of races. Up to a point these become almost platitudes to any student who is at pains to master them, but it is well worth while to indicate how "the English race itself develops slightly different characteristics answering to the differences of climate and geography. The Australian is one type, the Canadian is another, and both are slightly different from the Englishman at home, reared in narrower surroundings." Again, "men talk of India as if it were one country with a homogeneous population. Its unity is derived from British administration and railways alone." A course of six lectures on so vast a subject would not have admitted of any detailed investigation of these and other phenomena of empire. But the writer's points are made so clearly and forcibly that many of them suggest opportunity for such investigation as might be carried out by other lecturers and by students in advanced geographical classes. The present notice can only refer to these particular matters, but the whole series is characterized by a singularly wide outlook, and such topics are dealt with as the peculiar British capacity for imperial administration, and the benefits which have accrued therefrom to both British and non-British peoples, the writer's restraint and avoidance of any tendency towards what is known as waving the flag are to be noted with gratitude.

A Text-Book of Physical Geography.

'Physical Geography.' By Philip Lake. Cambridge Press. 1915.

The value of Mr. Lake's text-book of physical geography lies not so much in the subject-matter, which covers familiar ground, as in the mode of presentation.

Too many text-books are written in such a way that the student receives an unfortunate bias towards the opinions favoured by the respective authors. The extent to which hypothesis is presented as fact in modern text-books is not generally realized. Hence it is refreshing to find Mr. Lake adopting the principle of discriminating carefully between fact and theory. Alternative explanations are given without prejudice and the limitations of hypotheses are frequently remarked. His treatment of pressure and weather, of the tetrahedral hypothesis, of the continental shelf, of hanging valleys, and of boulder clay may be quoted as examples of his method. The encouragement thus given to students to test theory by fact is one of the most hopeful signs in modern teaching.

For the most part Mr. Lake has adopted the time-honoured subdivision of his subject. The atmosphere and the ocean are described from the point of view of constitution and properties, and the land from the point of view of processes. Interesting chapters are devoted to the discussion of the geographical distribution of atmospheric temperature and pressure, of ocean currents, and of superficial topography. Here and there old-fashioned prejudices may be traced. It is hard to understand, for example, why the coastal evidences of elevation and of subsidence should be termed geological rather than geographical. The formation of a valley is still loosely ascribed to the river it contains, although it is clearly explained that its characteristic form may be due to quite other agents. These, however, are small points in no way detracting from the value of the work itself, which is a notable addition to the number of standard text-books, and one which may be confidently recommended for the use of students.

J. D. F.

Petroleum.

'Petroleum: a treatise on the geographical distribution and geological occurrence of Petroleum and Natural Gas,' etc., etc. By Sir Boverton Redwood. 3rd edit. 3 vols. London: C. Griffin & Co. 1913. *Maps and Illustrations.* 50*s. net.*

A new edition of this standard work has been published.* It is accompanied by several new maps and plans, notably those of South Mexico and Trinidad. Information on the various fields has been brought more up to date, and the additional information necessitates the publication of the work in three volumes instead of two as formerly. There has been little added on the vexed question of the origin of petroleum. The rival theories of inorganic, vegetable, and animal origin are discussed and are summed up in the statement: "Approximation of product is consistent with wide variation of the generating factors." There are many additions in the section devoted to pipe lines, and a list of tank steamers and tank sailing vessels, as well as vessels fitted for burning oil fuel, has been brought up to date of publication. An index has been added that will facilitate reference to the enormous amount of information contained in this work, which can be looked upon as the standard work on petroleum and the allied shale industry.

H. T. B.

* For review of the second edition, see *Journal*, vol. **29**, p. 565.

THE MONTHLY RECORD.

ASIA.

Sir Aurel Stein in Central Asia.—A private letter written by this traveller in camp at Kucha on April 18 of this year, which has been kindly placed at our disposal, brings down the record of his experiences to a date considerably later than that on which his last communication printed in the May number of the *Journal* (vol. 45, p. 405) was written (November 22, 1914). The long desert journey from Turfan had been accomplished with complete success, though both the ground and the climatic conditions had been trying. Drinkable water had been scarce and icy winds experienced daily. With the aid of his two energetic survey assistants, travelling by different routes, large areas in the "Dry Mountains" hitherto imperfectly known had been mapped and the exploration of the ancient bed of Lop Nor completed. The earliest Chinese route into Central Asia has now been traced throughout, and all its ruined watch-stations and cemeteries searched for antiquities.* Since the winter the Indian triangulation net had been carried from the main Kun-lun across the Lop desert as far north as the Tien Shan, thanks to the true Sikh doggedness of Sir Aurel's old companion R. B. Lal Singh. The traveller himself was busy examining the old sites about Kucha, interesting in connection with the diminished water-supply within historic times. A careful study of modern conditions of irrigation is much needed, and there is a big field open for an irrigation engineer in all the oases. Sir Aurel had obtained permission from the Russian authorities to travel this summer in the mountainous tracts north of the Oxus. He hoped thus to see a historically interesting region—once part of Bactria—and to reach Seistan in the autumn. Here he would have the opportunity for a specially interesting study—in the remains and physical conditions of a miniature edition of the Lop basin. The traveller's safe arrival at Kashgar has since been reported.

The Vizagapatam Harbour Project.—The question of the creation of a harbour at Vizagapatam, to supply an outlet for a large area of fertile country hitherto undeveloped and without suitable access to the outside world, has been lately brought to the fore through a report to the Bengal-Nagpur Railway Company by their consulting engineers, Sir John Wolfe Barry and partners. This report, which was based on personal inspection, upholds the practicability of creating, at no very extravagant cost, an inland harbour to which access would be maintained by two breakwaters projecting into the sea, and by dredging a channel to the depth (in the first instance) of 24 feet. A deep-water quay would be provided, 1500 feet in length, with a possibility of supplying further accommodation in the future. Articles and correspondence on the subject have appeared in the Indian press and elsewhere, and these have been reprinted in pamphlet form by Mr. H. G. Turner, formerly closely connected as an official with the Vizagapatam district, together with various letters written to him by gentlemen interested in the scheme. It is understood that the question is meeting with sympathetic consideration on the part of the Indian Government, though some doubt seems to exist as to the best measures for the furtherance of the object in view. That the creation of such a port would have a beneficial influence on the development of a large area in East Central India seems unquestioned. It is pointed out that Vizagapatam, lying as it does in front of the only practicable gap in the barrier of the Eastern Ghats, is formed by nature to be the outlet of the Central Provinces, from

* It is not quite clear whether the whole of the above refers to work done since November, or whether the traveller is to some extent summarizing the general results of his expedition.

which a considerable amount of trade has taken this route in the past, even with the imperfect communications hitherto available. A necessary complement of the scheme would be the construction of the proposed railway by Parvatipuram to Raipur, which, with the existing coast-line of the Bengal-Nagpur railway, would make a large and rich area tributary to the proposed port, and obviate the long and expensive circuit by Calcutta. A link would also be supplied in the most direct route to Rangoon from Europe by way of Bombay, while from an imperial point of view the possible provision of a fortified port on the long and almost unprotected stretch of coast between Colombo and Calcutta is held to be a consideration of great importance. The lofty projecting headland of the Dolphin's Nose would, it is pointed out, offer facilities for this purpose, and it also plays an important part in throwing the strong southerly current out to sea and checking the formation of a bar at Vizagapatam.

AFRICA.

Portuguese East Africa: Erratum.—*Geographical Journal*, January, 1915: p. 36, line 4 from bottom, for "300" read "3000."

The Lost Forests of Africa: Erratum.—*Geographical Journal*, June, 1915: p. 518, line 17 from top, for "Gado-Welle" read "Lado-Welle."

AMERICA.

Work of the U.S. Geological Survey in Alaska.—A statement in *Science* for May 14 last, of the programme of work in Alaska during the present season by parties sent out by the U.S. Geological Survey, shows that the investigations of the resources of the territory no less than the more purely topographical and geological surveys are being continued with the energy that has characterized them for a number of years. No fewer than twelve such parties have been sent out, of which three will work in South-Eastern Alaska; one on the upper Chitina, an eastern tributary of the Copper River, where no geological work has hitherto been done; one in the Port Valdez district (Prince William Sound); two in the region between Turnagain Arm (Cook Inlet) and Knik, which will be tributary to the proposed Government railway, but has only partly been mapped; four in the central region between the Yukon, Tanana, and Kuskokwim rivers; and one will be engaged in general investigations in different parts of the territory. Among the most important undertakings are the surveys to be carried out in the Ruby district on the Yukon (now an important gold-placer camp) and neighbouring areas. They will extend southward to Takotna on the Kuskokwim, and eastward to the lower Tanana. In South-Eastern Alaska the available water-powers will be investigated in connection with recent industrial development; and both here and elsewhere various hot springs, some of which are already used as local sanatoria, will be studied. Mr. A. H. Brooks, the geologist in charge of the whole series of investigations, was to leave for Alaska about the end of June.

The Finger Lakes of New York.—A good deal has been written of late on this group of lakes from the point of view of their form and origin, in regard to which much influence is attributed to the action of the ancient ice. But there was room for a general limnological study of the lakes on the basis of data which had long been in existence, though not hitherto worked up and summarized. This has now been done by Messrs. E. A. Birge and C. Juday, known for previous studies of the lakes of Wisconsin, who have themselves carried out a personal investigation of the Finger Lakes. The paper in which the results are put forward has appeared in vol. **32** (1912) of the *Bulletin of the Bureau of Fisheries*, and has also been issued separately (Washington, 1914). It runs to 80 pages, and presents for the first time a systematic account of the lakes, with maps showing

the contours above and below the surface-level, based in part on long-unused surveys made by Cornell University from 1875 onwards, in part on the authors' own observations. The lakes, eleven in number, which owe their name to their long and narrow form, lie in more or less parallel valleys cut in the northern versant of the central plateau of New York State, and drained northwards towards Lake Ontario. The valleys are of pre-glacial origin, but were profoundly altered by the invasion of the ice; in every case but one they open independently upon the front of the highlands, and their northern ends coincide within a little with the northern ends of the lakes. The intervening ledges are highest towards the south, where the deepest parts of the lakes as a rule occur. The immediate shores are smooth and regular. Though similar in form and situation, the lakes differ widely in area and depth, those in the centre being both larger and deeper, and at a lower level, than the rest. The largest—Cayuga—is 38 miles long, with a maximum depth of 435 feet, while Seneca is 35 miles long and 618 feet deep. The authors paid special attention to the temperature observations, and the results from this point of view are of considerable importance. The study of the New York lakes was undertaken in order to test in larger bodies of water the principles of lake temperatures established for the lakes of Wisconsin, and it was found that the phenomena of the Finger Lakes exactly conform to those principles, which may be regarded as holding in general for lakes in similar climatic and topographic conditions. They appear to agree in the main with those established by the Scottish Lake Survey, though certain special points are brought out. In regard to the three vertical thermal regions into which the water of a lake is divided during the "equithermal" period in summer, the major lakes show a striking resemblance, even in the upper parts of the temperature curves, by which the relations of the "epilimnion" (or upper stratum of nearly uniform temperature) to the thermocline "* (or layer of maximum temperature gradient) are brought out. The thickness of the epilimnion depends on the opportunity offered for wind-distribution of warm surface water (all gain of heat above the temperature of maximum density and below about 16 feet being ascribed to such wind action), and the observations tend to show that about 40 to 50 feet is the greatest thickness to be expected in the epilimnion of lakes of this category. The annual "heat budget," to which much attention is directed, denotes the amount of heat required to raise the mean temperature from the winter to the summer figure. When liberated, this exercises a considerable local effect on the climate, the amount given off by one of the larger lakes being reckoned as equalling that produced by the combustion of nearly 10,000,000 tons of coal. A strong resemblance was found to exist between the heat budgets of the major lakes in the same year, and of the same lakes from year to year; and it appears—within limits, and for lakes of the class in question—to be independent of surface dimensions.

The Upper Missouri in Pre-Glacial Times.—The vicissitudes suffered by the great drainage systems of North America as a result of the post-Tertiary glaciation form an interesting study, presenting various still unsolved problems. While there is no doubt that the drainage of the great lakes was, at one stage of the retreat of the ice-sheet, south to the Mississippi, there is equal ground for believing that the drainage of the Upper Missouri was at a still earlier period carried north towards Hudson Bay. The late Tertiary history of this river is sketched by Mr. C. M. Bauer in the *Journal of Geology* (Chicago) for January–February, 1915 (vol. 23, No. 1). This writer brings together the evidence which exists in the form of ancient, in great part drift-filled, river channels running north and north-east across the Missouri Coteau, by which its waters and that of other streams of the Missouri

* This convenient term was introduced by Prof. Birge some years ago, and corresponds to the "discontinuity layer" of Wedderburn.

system must once have found their way towards the Assiniboine and Lake Winnipeg. One of these runs from the present Missouri near Poplar, Montana, to the extreme north-west corner of North Dakota, and the idea that such was once the course of the Missouri finds support from a study of the elevations along this line, which show a greater fall to the north-east than is experienced by the present Missouri itself. Further west, there is evidence that the upper Missouri flowed north-east into the present Milk River, the valley of which, below the junction of the supposed old channel, suddenly broadens and must have once been occupied by a far larger stream. The present course of the Yellowstone shows few changes due to glaciation, but it probably continued north across the Missouri Coteau in Tertiary times, as did the Little Missouri, which joins the main Missouri from the south in North Dakota; the two streams having probably united near Williston, North Dakota. The writer endeavours to trace the history of these streams from the close of the Cretaceous period down to the early Quaternary uplift and northern glaciation by which the outlets to the north became blocked, first by ice, later by drift and outwash.

Earthquake Phenomena in Panama.—Mr. D. F. Macdonald, of the U.S. Geological Survey, describes in *Science* for May 28 last some earthquake phenomena observed by him in Panama in 1913 when acting under a commission from the President of the Republic to investigate the causes of the shocks experienced during October in the Aznero Peninsula. Simultaneously with the first and heaviest shock, the cable from Panama up the west coast broke at the point where it passes over the submarine escarpment bounding the continental shelf, and was subsequently found to be buried under *débris* for half a mile. The explanation seems to be that movement occurred along an old fault scarp or zone, causing the earthquake, which in turn occasioned a submarine land-slide. Nearly all the later shocks were accompanied by peculiar underground sounds which seemed to pass from east to west, and were probably due to the formation of small shears or strain-relieving cracks in the rocks, though none such were actually seen at the surface. During one of the heavier shocks the writer was on a steep conical peak, which he describes as behaving like a stiff jelly, giving a striking indication of the elasticity of solid rock. The underground sounds had a terrifying effect on the inhabitants.

AUSTRALASIA AND PACIFIC ISLANDS.

The Trans-Australian Railway.—An extract from a recent report of the Chief Commonwealth Railway Engineer, giving some details of the progress of construction of the east-to-west transcontinental railway of Australia (*Journal*, vol. **39**, p. 287), has been received from the office of the High Commissioner for Australasia. It states that the Western Australian Division Survey is complete, and the route has been permanently located to 280 miles. Thence to the border the permanent survey will proceed in advance of plate-laying. The South Australian Survey is complete. It is estimated that the rails will be laid throughout before the end of next year, although the rate of progress will be reduced by the very heavy earthworks soon to be taken in hand in the South Australian section. During the three months preceding the date of the report 240 miles had been laid. The line is to be ballasted throughout, and arrangements had been made to select quarry sites and erect the necessary plant for rock-crushing. In view of the scanty water-supply on the route, reservoirs have to be provided at various points, and several are in course of construction. They include one at Karonia, W.A. (late Cardonia), with an approximate capacity of 7,000,000 gallons; one at Bookloo, S.A. (6,000,000 gallons); and one each at Windabout and Eucla (5,000,000 gallons). Boring operations have been carried on in both divisions.

Dutch Exploration in North-Western New Guinea.—Some details of the expedition of Lieut. Stroeve from the Mamberamo to Geelvink Bay (*Journal*, vol. 45, pp. 81, 442), as well as of an exploration of the Idenburg river (the main eastern headstream of the Mamberamo), by a party under the orders of Captain Oppermann, are given in the May number (1915) of the *Tijdschrift* of the Netherlands Geographical Society. Lieut. Stroeve's route was planned to follow a western tributary of the Rouffaer river explored by him, and the ascent of this was begun on August 17, 1914. The journey proved one of the most difficult yet carried out in New Guinea. After one day's ascent the canoes had to be left behind, the further route leading across a swampy tract to the water-parting range, which was climbed with arduous toil by paths cut through the dense vegetation. At last the course of the Wa Poga, flowing into Geelvink Bay, was struck and followed down, rafts being used for part of the way. Supplies were lost in the rapids, and it was necessary to scour the country in search of sago. Lastly the expedition was attacked by hostile natives, and Lieut. Stroeve was killed. A narrative of these experiences is given in the form of extracts from a journal kept by Lieut. Ilgen, who, with the rest of the survivors, was eventually picked up by the Government steamer *Albatros*. The expedition to the opposite (eastern) extremity of the Mamberamo basin succeeded, in spite of considerable difficulties, in exploring the Idenburg river almost to its source, as well as an eastern tributary which brought the explorers very close to the farthest point reached from the opposite direction by Captain Sachse during the survey of the Dutch-German frontier in 1910 (*Journal*, vol. 37, p. 216). The exploration lasted from May to October, 1914, some time being occupied in the passage of two successive gorges, the lower of which had been the limit of previous exploration. Beyond them the river, which in its lower course has a general direction from east-south-east to west-north-west, was found to make a big bend, its headstream flowing from west of north. Barricades of tree-trunks impeded the advance and necessitated dragging the canoes overland. The highest section of the river was called Nawa by the natives; at the point where exploration ceased it was still 30 to 40 yards wide. The ascent of the eastern tributary failed to bring the party to the Keerom (Turn-back) river of Sachse, found by him flowing west towards the Mamberamo. But a branch which had been passed by was afterwards examined for a short distance and must certainly be the Keerom, as the distance from Captain Sachse's turning point was only at most 15 miles and probably less. The threatening attitude of the natives then made a return advisable.

HISTORICAL GEOGRAPHY.

Trade Route across Northern Persia in the First Century B.C.—Mr. W. H. Schoff, whose work on the 'Periplus of the Erithræan Sea' was reviewed a few years ago in the *Journal* (vol. 39, p. 606), has now brought out, as a publication of the Commercial Museum at Philadelphia, the 'Parthian Stations' of Isidore of Charax, both in the original Greek and in English translation, together with a detailed commentary. Apart from fragments preserved by later writers this brief record is the only part of the writings of Isidore that has come down to us, and is valuable as one of the few records of the overland trade route from Antioch to the borders of India as used in the time of Augustus. The work, which is of course well known to students of the ancient geography of the East (it was included in Müller's collection of 'Geographi Græci Minores'), constitutes a detailed statement of the stations on the trade route and the distances between them, but it incidentally sheds some light on the political conditions of the time. The itinerary extends from Zeugma on the Euphrates (where the river was crossed by Crassus in 55 B.C. during his disastrous campaign against the Parthians) to

Alexandropolis, the modern Kandahar. This northern route, Mr. Schoff points out, was the ancient trade route of the Medes and the Assyrians, but the rise of the power of Persia diverted much of the trade to the Royal Road *viâ* Susa to the modern Sistan, where the two routes converged. Under the Parthians the northern route seems to have regained some of its lost importance, though still suffering the competition of that through Carmania and Persia to Charax Spasini (most probably the home of Isidore) at the head of the Persian Gulf. In his commentary, Mr. Schoff notes the accepted identifications of places on the route, and elucidates historical references by quotations from ancient and modern writers. The lost works of Isidore seem to have included a more comprehensive description of Parthia and a general treatise on geography.

The World-map of Peter Plancius, 1592.—In No. VI. of his series of articles on Early Dutch Geographical Documents,* to which reference has already been made more than once in the *Journal* (vol. **45**, p. 163; **46**, p. 68), Dr. Wieder deals fully with the important map preserved at Valencia, which he identifies with the long-lost map of Peter Plancius, referred to by Blundeville in his well-known "Exercises." The map is in eighteen sheets plus two narrow strips; the whole, including the ornamental border, measuring 7·64 by 4·79 feet (the map surface alone, 7·02 by 3·48 feet). It is engraved and coloured, mounted on linen, and framed. The general map, on a simple rectangular projection, occupies sheets 7–18 (in two tiers), while star maps and representations of the northern and southern hemispheres occupy the corners. The title, which appears at the top in large letters on sheets 2–5, runs: "Nova et exacta Terrarum orbis tabula Geographica ac Hydrographica," and the names of the well-known engravers, J. and B. van Deutecom, appear on a cartouche on sheet 15: "Johannes á Dotecom unâ cum filio Baptista á Dotecom fecerunt." A long inscription in Latin, headed "Geographiæ Studioso," is placed at the foot of sheet 16, and gives important indications as to the authorship and sources of the map, though Plancius's name does not actually appear. On two of the sheets slips have been pasted—one with the inscription, "Antwerpiæ apud Ioannem Baptistam Vriendt;" two others containing the arms of, and dedication to, Cardinal Albertus van Oostenrijk; while on a fourth Vrient's name appears again, with the date 1592. Now documents exist showing that in 1592 Peter Plancius offered a map to the States General; that a "privilege" for twelve years was granted to him and the publisher, Cornelis Claesz.; and that a payment of 300 gulden was voted for the map. The descriptions herein contained agree almost verbally with that in the inscription "Geographicæ Studioso"; it is spoken of as a *geographical and hydrographical map* (a combination not usual before that time), while both the map and the privilege speak of the Portuguese originals on which the map was founded.† There are thus good grounds for ascribing the Valencia map to Plancius, the discrepancy as to the publisher being due to the pasting of the label with Vrient's name over that of Claesz., if, as is probable, the latter was originally engraved on the map. It is possible that, by reason of the expense of production, the two publishers joined forces for the purpose, as they are known to have done in other cases. Dr. Wieder gives a brief indication of the geography of the map, which seems to bear a general resemblance to others of its time. The magnetic pole and four great Arctic islands are reproduced from Mercator. The Strait of Anian figures between Asia and America, and New Guinea

* *Tijdschrift*, Netherlands Geogr. Society, 1915, No. 3.

† Copies of Portuguese charts, no doubt similar to, if not identical with, those used for this map, are still in existence in Holland. The extensive use of Portuguese MS. maps in the century in question is well known, and one such, dating from about 1550, is in the Society's collections.

is shown as separate from the southern continent. The recent extension of knowledge to the north of Norway finds expression in an inset on sheet 16, though not on the general map, which, however, gives a better representation of America than those of other Netherlands map-makers. The unknown interior of North America is utilized for inscriptions giving information on voyages of discovery, including that of Verrazzano. As in Plancius's small map (in hemispheres) of 1594, North and South America bear the names Mexicana and Peruana respectively, and the Southland, Magalanica. The last part of the paper deals with passages in contemporary writers (Blundeville and others), which show that Plancius's large map did actually see the light, and that it was held in high esteem. That it was reprinted in London in 1595 is proved by a statement by A. Linton in his work on the art of navigation. The Valencia copy lacks the letter-press issued for attachment at the foot, and reproduced by Blundeville; this probably bore Plancius's name, and supplied the link definitely connecting the map with him as author.

GENERAL.

Paper-making Materials from the British Empire.—The vast consumption of paper at the present day renders the question of an adequate supply of paper-making materials an important and difficult one, in view of the possible future diminution in the supply of wood-pulp with the exhaustion of the forests whence it is at present obtained. A comprehensive review of the sources of supply, both of wood-pulp and other fibrous material, within the Empire, was undertaken by Mr. S. C. Phillips in a paper read before the *Society of Arts* on May 4 last, and printed, with the discussion that followed, in the *Journal* of the Society for May 21. As the material from which the bulk of the cheaper papers are now made, wood-pulp naturally takes a prominent place in the survey, and, as one of the main sources of the supply of wood-pulp, Canada occupies an equally important place among the parts of the Empire taken into consideration. But many other possible substitutes, either for wood-pulp or esparto, which have been experimented with of late years, are also referred to in succession. The almost inexhaustible nature of the Canadian and Newfoundland forests is dwelt upon, and in this connection the writer is perhaps somewhat inclined to consider the question from the point of view of the paper-maker only, to the neglect of the wider aspects of the timber supply of the future. He considers it "gratifying to know that Canada at the present time supplies the world with 320,000 tons, approximately, of paper-making materials" yearly, and seems sanguine as to the adequacy of the present conservation movement to make the forest resources last out for an indefinite time to come. He allows, however, that the use of spruce for pulp "may in one sense, perhaps, be regarded as wasteful." The possibilities of a supply of material in the British Isles, whether from wood or peat, he does not consider hopeful. From India, as also from Australia, in addition to bamboo, a number of grasses and other plants have been tested with more or less promising results; while from Africa, papyrus and other reeds and grasses, as well as wood like that of the baobab, have come under serious consideration. It is greatly to be wished that some of these secondary sources may in time prove a commercial success, for, as remarked by Mr. H. A. Bromley of H.M. Stationery Office, a very serious depletion of the world's forest resources is now going on—largely, unfortunately, to supply a demand for purely ephemeral purposes.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1914–1915.

Fifteenth Meeting, June 28, 1915.—Douglas W. Freshfield, Esq., President, in the Chair.

Elections.—*Herbert Ashmead; Lieut. Edward William Bovill* (*10th Royal Hussars*); *Mrs. Robert Woods Bliss; James Currie; Sir William H. D. Haggard, C.B., K.C.M.G.; Bernard Heape, B.A.; James MacKenzie; William McLeish.*

The paper read was:—

"The Map of Europe and the Near East." Compiled by the Society for the General Staff. By Arthur R. Hinks.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Académie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Eastern. *National G. Mag.* **27** (1915): 321–376. **Albrecht.**
Austro-Italian Mountain Frontiers. By Florence Craig Albrecht. *Illustrations.*

Austria-Hungary. *G.Z.* **21** (1915): 1–22, 83–105, 121–131. **Sieger.**
Die geographischen Grundlagen der österreichischen-ungarischen Monarchie. Von Dr. Robert Sieger.

Balkan Peninsula. *Scottish G. Mag.* **31** (1915): 281–303. **Newbigin.**
The Balkan Peninsula: its Peoples and its Problems. By Marion I. Newbigin. *Maps.*

Bulgaria. **Fox.**
Bulgaria. By Frank Fox. London: A. & C. Black, 1915. Size 9 × 6, pp. viii. and 208. *Sketch-map and Illustrations. Price* 10*s. net.*

Eastern Europe—Political. *G.Z.* **21** (1915): 148–153. **Hettner.**

Russland und die Meerengen. Von Alfred Hettner.

Europe—Political. **Belloc.**

The two maps of Europe, and some other aspects of the Great War. By Hilaire Belloc. London: C. A. Pearson, 1915. Size 7½ × 5, pp. 128. *Diagrams, Sketch-maps, and Illustrations. Price* 1*s. net. Presented.*

A reprint of articles written during the earlier stages of the war. The "two maps" show the re-arrangements favoured by the two sides in the great conflict.

Europe—River voyage. **Rowland.**

Across Europe in a Motor boat. A chronicle of the adventures of the motor-boat *Beaver* on a voyage of nearly 7000 miles through Europe by way of the Seine, the Rhine, the Danube, and the Black Sea. By Henry C. Rowland. London: D. Appleton & Co., 1915. Size 8 × 5½, pp. viii. and 304. *Illustrations. Price* 7*s.* 6*d. net.*

Germany—Schleswig-Holstein. **Krumm and Stoltenberg.**

Unsere meerumschlungene Nordmark. Ein Heimatbuch in Wort und Bild herausgegeben von Hermann Krumm und Fritz Stoltenberg. 2 vols. Kiel: Lipsius & Tischer, [1915]. Size 11½ × 8, pp. (vol. 1) xx. and 440; (vol. 2) xx. and 392. *Illustrations. Price* 22*s.* 6*d.*

The first volume deals with the land, the second with the history and economics.

Italy—Alps—Erosion. *B.R.S.G.* (*Rome*) V., **14** (1915): 513–542. **Saragat.**

Il "valgello" e la protezione del monte. By Aurelio Saragat. *Illustrations.*

Valgello is a local term for the small torrents, in great part temporary, by which much of the most active erosion of the mountains is effected.

Italy—Apulia. *La G.* (*De Agostini*) **3** (1915): 111–116. **Sacco.**

Le Regioni geologiche e geografiche della Puglia. By Federico Sacco.

Italy—Sardinia—Maddalena. *La G.* (*De Agostini*) **3** (1915): 116–122. **Manara.**

La Maddalena. By Rosetta Manara.

A small island between Sardinia and Corsica.

Italy—Seismology. *La G.* (*De Agostini*) **3** (1915): 106–111. **Baratta.**

Le condizioni sismiche della regione marsicana. By Mario Baratta. *Illustration.*

The region is that of the Abruzzi, Central Apennines.

Italy and Adriatic. *La G.* (*De Agostini*) **3** (1915): 102–106. **Sacco.**

L'Italianità geologica della Venezia Tridentina e dell' Adriatico. By Federico Sacco.

Urges the intimate geological relations between Italy and the region to the east.

Italy and Austria—Political. *La G.* (*De Agostini*) **3** (1915): 81–102. **Galanti.**

I diritti storici ed etnici dell' Italia sulle terre irredente. By Arturo Galanti. *Map.*

North-Western Europe. *G.Z.* **21** (1915): 153–163. **Wagner.**

Fennoskandia. Nach A. G. Högbom. Von Dr. Paul Wagner. *Maps.*

Poland. **Eversley.**

The partitions of Poland. By Lord Eversley. London: Fisher Unwin, 1915. Size 9 × 5½, pp. 328. *Sketch-map. Price* 7*s.* 6*d. net. Presented.*

Poland. **Hill.**

Poland and the Polish question. Impressions and afterthoughts. By Ninian Hill. London: Allen & Unwin, 1915. Size 9 × 5½, pp. 340. *Map and Illustrations. Price* 10*s.* 6*d. net.*

Rumania—Historical. *G.Z.* **21** (1915): 277–283. **Lehmann.**

Rumänien als Durchgangsland und Kriegsschauplatz in Mittelalter und Neuzeit. Von Dr. F. W. Paul Lehmann.

Scandinavia. **Leach.**

Scandinavia of the Scandinavians. By Henry Goddard Leach. London: Sir Isaac Pitman, 1915. Size 7½ × 5½, pp. x. and 332. *Maps and Illustrations. Price* 6*s. net. Presented.*

Serbia. *Scottish G. Mag.* **31** (1915): 303–315. **Low.**

The Kingdom of Serbia: her People and her History. By D. H. Low. *Illustrations.*

Spain—Economic. *G.Z.* **21** (1915): 283–291. **Müller.**

Zur Wirtschafts- und Handelsgeographie Spaniens. Eine zeitgemässe Orientierung. Von Dr. Ernst Müller.

Sweden—Gothland—Erosion. **Munthe.**

Sveriges Geol. Undersökning, Årsbok 1912, No. 3, pp. 44.

Några glaciofluviala erosionsformer på Gottland. Av Henr. Munthe. *Map and Illustrations.*

Sweden—Jämtland—Glaciation. **Frödin.**

Sveriges Geol. Undersökning, Årsbok 1912, No. 7, pp. 80.

Glacialgeologiska studier i Nordvästra Jämtland. Av Gustav Frödin. *Maps and Illustrations.*

Sweden—Jämtland—Glaciation. **Eriksson.**

Sveriges Geol. Undersökning, Årsbok 1912, No. 5, pp. 180.

Inlandsisens avsmältning i sydvästra Jämtland. Av. Kjell Eriksson. *Illustrations.*

Sweden—Moors. *Sveriges Geol. Undersökning, Årsbok* 1912, No. 2, pp. 52. **Von Post.**

Ueber die Stratigraphische Zweigliederung Schwedischer Hochmoore. Von Lennart von Post. *Illustrations.*

Sweden—Örebro. *Sveriges Geol. Undersökning, Årsbok* 1912, No. 4, pp. 16. **De Geer.**

Geografisk undersökning av sjöarna Toften, Testen och Tysslingen i Närke. Av Sten de Geer. *Map.*

Small lakes drained into Lake Hjälmar by the Närkes Svartå.

Sweden—Valley-forms. **De Geer.**

Sveriges Geol. Undersökning, Årsbok 1912, No. 6, pp. 19.

Niplandskap vid Dalälven. Av Sten de Geer. *Map.*

Switzerland—Lakes. *Geol. Mag.*, Dec. VI., **2** (1915): 215–224. **Preller.**

The Zonal Lake Basins of sub-Alpine Switzerland. By C. S. Du Riche Preller. *Maps and Sections.*

Turkey—Sea of Marmora. *C.R.A. Sc.* **160** (1915): 603–605. **Arabu.**

Etudes sur les formations tertiaires du bassin de la mer de Marmara: Synthèse des données relatives au Néogene: le moment d'apparition du sillon de la mer de Marmara. By M. N. Arabu.

United Kingdom—Place-names. **Sedgefield.**

The Place-names of Cumberland and Westmorland. By Dr. W. J. Sedgefield. London: Longmans, Green & Co., 1915. Size 9½ × 6, pp. xliv. and 208. *Price* 10*s.* 6*d. net.*

United Kingdom—Renfrew. *Scottish G. Mag.* **31** (1915): 225–240. **Scott.**

The County of Renfrew. By C. A. Scott. *Diagrams.*

United Kingdom—Wales—Archæology. **Wright.**

Aberystwyth studies, by Members of the University College of Wales. 2 vols. Aberystwyth: The College, 1912–14. Size 10 × 6, pp. (vol. 1) 128; (vol. 2), 106. *Diagrams. Presented.*

Includes papers on Ancient Earthworks near Aberystwyth, by F. S. Wright.

ASIA.

Asia—Anthropology. *J. College Sc., Imp. Univ. Tokyo* **36** (1914): Art. 6, pp. 35. **Torii.**

Etudes Anthropologiques. Les Mandchoux. By R. Torii. *Illustrations.*

Ceylon—Survey. **Ingles.**

Ceylon. Administration Reports, 1914. Survey Report of Mr. W. C. S. Ingles, N.P., N.D. Size 13½ × 8½, pp. 10. *Maps.*

Malay Archipelago—Celebes. **Gracht.**

Ts. K. Nederl. Aardr. Gen., 2 S. **32** (1915): 188–204.

Voorloopige mededeeling in zake de geologie van Centraal Celebes. Van W. A. J. M. van Waterschoot van der Gracht. *Illustration.*

Malay Archipelago—Sumatra—Erosion. **Brouwer.**

Ts. K. Nederl. Aardr. Gen., 2 Ser., **32** (1915): 338–345.

Erosieverschijnselen in puimsteentuffen der Padangsche Bovenlanden. By H. A. Brouwer. *Illustrations.*

Persia—Bibliography. ———

List of Works in the New York Public Library relating to Persia. (From the *Bulletin* of the New York Public Library, vol. 19, No. 1, pp. 9–126.)

Persian Gulf. *J.R.S. Arts* 63 (1915): 505–518. **Landon.**

Basra and the Shatt-ul-Arab. By Perceval Landon. *Sketch-map.*

Philippine Islands—Forests. **Brown and Matthews.**

Philippine J. Sc. 9, Sec. A. (1915): 413–516, 517–561.

The Philippine Dipterocarp Forests. By William H. Brown and Donald M. Mathews. *Map and Illustrations.*

Turkey—Palestine. ———

Palestine Exploration Fund. Annual 1914–1915. Double volume. London, [1915]. Size 11½ × 8½, pp. xvi. and 154. *Plans and Illustrations. Presented.*

Western Asia—Historical. **Schoff.**

Parthian Stations. By Isidore of Charax. An account of the Overland Trade Route between the Levant and India in the First Century B.C. The Greek text, with a translation and commentary by Wilfred H. Schoff. Philadelphia, 1914. Size 9½ × 6, pp. 46. *Sketch-maps and Illustrations.*

See note in the Monthly Record, *supra*, p. 158.

Western Asia—Irrigation and Population. *Man.* 15 (1915): 68–71. **Cresswell.**

Fluctuations in the Population of Irrigated Countries. By K. A. C. Cresswell.

AFRICA.

Africa—Fishes. **Boulenger.**

Catalogue of fresh-water fishes of Africa in the British Museum (Natural History). Vol. 3. By George Albert Boulenger. London: Longmans & Co., 1915. Size 11 × 7½, pp. 526. *Illustrations. Presented.*

Africa—German Colonies. **Lewin.**

The Germans and Africa. Their aims on the Dark Continent and how they acquired their African Colonies. By Evans Lewin. With an Introduction by the Rt. Hon. Earl Grey. London: Cassell & Co., 1915. Size 9½ × 6½, pp. xviii. and 318. *Map. Price* 10*s.* 6*d. net.*

British East Africa. ———

East Africa Protectorate. Report for 1913–14. (Colonial Reports, Annual, No. 840.) London, 1915. Size 9½ × 6, pp. 67. *Map.*

German East Africa. ———

Germany. Report for the years 1912–13 on the Trade, Commerce, and Economic Position of German East Africa. (No. 5441, Annual Series. Diplomatic and Consular Reports.) *Sketch-map.*

Italian Colonies. **Giampiccolo.**

E. Giampiccolo. Le Colonie Italiane in Africa: Eritrea—Somalia—Libia. Studio storico-geografico. Catania, 1914. Size 9½ × 6½, pp. 144. *Maps. Price* 2*s.* 9*d.*

Madagascar. **Giraud.**

Nouvelles Archives des Missions Scientifiques et Littéraires. Nouv. Sér., Fasc. 13. Rapport de Mission à Madagascar (30 Octobre 1912—27 Août 1913). Par Jean Giraud. Paris, 1914. Size 9½ × 6½, pp. 47. *Diagrams.*

Studies in geology and mineralogy.

Portuguese Guinea. **Loureiro da Fonseca.**

B.S.G. Lisboa 32ª Sér. (1914): 429–476.

Guiné. Alguns aspectos ineditos da actual situação da colonia. By A. Loureiro da Fonseca.

Red Sea. **Cufino.**

Luigi Cufino. Nel Mar Rosso. Naples, 1914. Size 10 × 7, pp. xvi. and 192. *Map and Illustrations. Price* 7*s.* 6*d.*

Report of a mission sent out on behalf of the Italian African Society to study the trade conditions.

South Africa—Cape Colony. **Scully.**

Lodges in the Wilderness. By W. C. Scully. London: Jenkins, Ltd., 1915. Size 8 × 5, pp. 252. *Illustrations. Price* 5*s. net. Presented.*

Zambesi—Language. **Griffin.**

Chitonga vocabulary of the Zambesi Valley. By A. W. Griffin. London: H. Milford, 1915. Size 7 × 4½, pp. 160. *Price 4s. net. Presented.*

NORTH AMERICA.

Alaska—Geology. *U.S. Geol. Surv., B.* 576 (1914): pp. 56. **Moffit.**

Geology of the Hanagita—Bremner Region, Alaska. By Fred. H. Moffit. *Maps and Illustrations.*

Alaska—Minerals. *U.S. Geol. Surv., B.* 592 (1914): pp. 413, xi. **Brooks and others.**

Mineral Resources of Alaska. Report on progress of investigations in 1913. By Alfred H. Brooks and others. *Maps.*

Canada—British Columbia. **Drysdale.**

Canada, Geol. Surv., Mem. 56 (1915): pp. vii., 246 and vi.

Geology of Franklin Mining Camp, British Columbia. By Charles W. Drysdale. *Maps and Illustrations.*

Contains chapters on the Physiography and General and Structural Geology.

Canada—British Columbia. **Reinecke.**

Canada, Geol. Surv., Museum B. No. 11 (1915): pp. 58.

Physiography of the Beaverdell map-area and the southern part of the interior plateaus of British Columbia. By Leopold Reinecke. *Maps and Illustrations.*

Canada—British Columbia—Hydrography. **Swan.**

Department of the Interior, Canada, Water Power Branch, Water Resources Paper No. 8. Report of the British Columbia Hydrographic Survey for the calendar year 1913. By R. G. Swan. Ottawa, 1915. Size 10 × 6½, pp. xvi. and 367. *Maps and Illustrations.*

Canada—Fisheries. **Melvill, Lower, and Comeau.**

Department of the Naval Service. Appendix to the Annual Report of the Department of the Naval Service for the fiscal year ending March 31, 1914. Reports on Fisheries Investigations in Hudson and James Bays and tributary waters in 1914. By C. D. Melvill, A. R. M. Lower, and Nap. A. Comeau. Ottawa, 1915. Size 10 × 6½, pp. 85. *Map and Illustrations.*

Canada—Nelson and Churchill Rivers. **McInnes.**

Canada, Geol. Surv., Mem. No. 30 (1913): pp. vii. + 146.

The Basins of Nelson and Churchill Rivers. By William McInnes. *Map and Illustrations.*

Canada—Ontario—Gold. **Tyrrell.**

The occurrence of gold in Ontario. By J. B. Tyrrell. (Excerpt *T. I. Mining and Metallurgy*, vol. 23, 1913-1914.) London, N.D. Size 8½ × 5½, pp. 143-162.

Canada—Place-names. **Tyrrell.**

Algonquian Indian Names of Places in Northern Canada. By J. B. Tyrrell. (From *T. R. Canadian I.*) Toronto, 1915. Size 10 × 7, pp. 213-221.

Canada—Rockies. **Jobe.**

My Quest in the Canadian Rockies. By Mary L. Jobe. From *Harper's Mag.*, vol. 130, 1915, pp. 813-825.) Size 10 × 7. *Illustrations.*

See July number, p. 65, *note.*

Mexico. **Flandrau.**

Viva Mexico! By Charles Macomb Flandrau. London: D. Appleton & Co., 1914. Size 7 × 5, pp. 294. *Price 5s. 2d.*

Newfoundland—Aborigines. **Howley.**

The Beothucks or Red Indians. The aboriginal inhabitants of Newfoundland. By James P. Howley. Cambridge: University Press, 1915. Size 12 × 9, pp. xx. and 348. *Illustrations. Price 21s. net. Presented.*

United States—Arizona. **Barringer.**

P.A. Natural Sc. Philadelphia 66 (1914): 556-567.

Further notes on Meteor Crater, Arizona. By Daniel Moreau Barringer. *Illustrations.*

A first paper appeared in the above publication in 1905, and a second was read before the National Academy of Sciences at Princeton University in 1909.

United States—Bibliography.

Geography, Travel, Exploration. Descriptive Government Publications, many illustrated. Sold by the Superintendent of Documents, Washington, D.C. [Washington], 1914. Size 9 × 6, pp. 51.

United States—Cascades. *J.G.* **13** (1915): 242–250. **Telker.**

The Cascade Mountains. By Minna J. Telker.

United States—Economic—Slate. **Dale and others.**

U.S. Geol. Surv., B. 586 (1914): pp. 220.

Slate in the United States. By T. Nelson Dale and others. *Maps and Illustrations.*

United States—Geodetic Survey.

United States Coast and Geodetic Survey. Description of its work, methods, and organization. Washington, 1915. (*U.S. Coast and Geodet. Surv., Special Publ.*, No. 23.) Size 9 × 6, pp. 56. *Maps and Illustrations.*

United States—Hydrology. **Wood.**

U.S. Geol. Surv., Water Supply Papers, 340—C, D, E (1914): pp. xxii., 31–42; xx., 43–52; xxi., 53–61.

Stream-gauging stations and publications relating to water resources 1885-1913. Part III.—Ohio River Basin. Part IV.—St. Laurence River Basin. Part V.—Hudson Bay and Upper Mississippi River Drainage Basins. Compiled by B. D. Wood.

United States—Illinois. **Rich.**

Some peculiarities of glacial erosion near the margin of the continental glacier in Central Illinois. By John L. Rich. (From the *B. American Geol. S.*, vol. **26**, 1914.) N.P., 1814. Size 10 × 6, pp. 70–72. *Sketch-map and Illustrations.*

United States—Maryland—Historical. **Morris.**

Johns Hopkins Univ. Studies, 32 (1914): No. 3, pp. 157.

Colonial Trade of Maryland, 1689–1715. By Margaret Shove Morriss.

United States—Montana. *U.S. Geol. Surv., B.* 600 (1915): pp. 54. **Campbell.**

The Glacier National Park. A popular guide to its geology and scenery. By Marius R. Campbell. *Maps and Illustrations.*

United States—Pennsylvania. *B.G.S. Philadelphia* **13** (1915): 64–71. **Harshberger.**

Nature and Man in the Pocono Mountain Region, Pennsylvania. By W. Harshberger. *Illustrations.*

United States—Physiography. **Fenneman.**

Ann. Assoc. Amer. Geographers **4** (1915): 84–134.

Physiographic boundaries within the United States. By N. M. Fenneman. *Maps.*

United States—Sierra Nevada. *Sierra Club B.* **9** (1915): 225–239. **Muir.**

Studies in the Sierra; I. Mountain Sculpture. By John Muir. *Illustrations.*

United States—Tennessee. *J.G.* **13** (1915): 233–241. **Gregory.**

The Geography of Tennessee. By W. M. Gregory.

United States—Triangulation. **Bowie.**

U.S. Coast and Geodetic Survey, Special Publ. No. 19, pp. 152.

Primary Triangulation on the one hundred and fourth meridian, and on the thirty-ninth parallel, in Colorado, Utah and Nevada. By William Bowie. *Maps and Illustrations.*

United States—Utah. *U.S. Geol. Surv., Prof. Paper* 90-F. (1914): pp. 60. **Loughlin.**

A Reconnaissance in the Canyon Range, West-Central Utah. By C. F. Loughlin. *Sketch-map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine—Surveys.

República Argentina. Estado mayor del ejército, 3ª division. Anuario del Instituto Geográfico Militar. 3er vol. 1914. Buenos Aires, 1914. Size 11½ × 9, pp. 139 + 133. *Maps and Illustrations.*

Panama Canal. **Bakenhus and others.**

The Panama Canal. Comprising its history and construction, and its relation to

the navy, international law, and commerce. By Reuben E. Bakenhus, Harry S. Knapp, and Dr. Emory R. Johnson. 1st edit. London: Chapman & Hall, 1915. Size 9½ × 6, pp. viii. and 258. *Maps, Illustrations, and Sections. Price* 10*s.* 6*d. net.*

Panama Canal. **Canal Commission.**

Annual Report of the Isthmian Canal Commission and the Panama Canal for the financial year ended June 30, 1914. Washington, 1914. Size 9½ × 6, pp. xxii. and 602. *Illustrations and Sections; Maps and Diagrams in separate case.*

AUSTRALASIA AND PACIFIC ISLANDS.

Hawaii—Surveys. *U.S. Geol. Surv., B.* 561 (1914): pp. 42. **Marshall.**

Results of Spirit Levelling in Hawaii, 1910 to 1913 inclusive. By R. B. Marshall. *Illustrations.*

New Guinea—Dutch. *Ts. K. Nederl. Aardr. Gen.* 2 Ser., 32 (1915): 366–376. ——

De exploratie van Nieuw-Guinea. By J. J. S. *Sketch-map.*

Further accounts of Lieut. Stroeve's expedition (by G. A. Ilgen), and work in the upper basin of the Mamberamo under Captain Oppermann (*supra*, p. 158).

Western Australia—Geology. **Geological Survey.**

Western Australia, Geol. Surv., B. 61 (1914): pp. 240.

An outline of the physiographical geology (physiography) of Western Australia. By J. T. Jutson. *Maps, Illustrations, and Sections.*

MATHEMATICAL GEOGRAPHY.

Cartography—International Map. **[Aparicio.]**

La 2ª Conferencia Internacional del Mapa al Millonésimo (Paris, Diciembre de 1913). Informe presentado al Ministerio de Relaciones Exteriores por el Delegado del Gobierno Argentino a dicha Conferencia. (Publicacion del Instituto Geográfico Militar. Coronel Benjamín García Aparicio, Jefe.) Buenos Aires, 1915. Size 8½ × 6, pp. 117. *Maps and Illustrations.*

Map-reading. **War Office.**

Manual of map reading and field sketching, 1912. (Reprinted, with additions, 1914.) Issued by command of the Army Council, War Office. London: Wyman & Sons, 1914. Size 7 × 5, pp. 102. *Maps and Diagrams. Price* 1*s.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. *B. American G.S.* 47 (1915): 184–189. **Huntington.**

Terrestrial and Solar Changes. By Ellsworth Huntington. *Illustrations.*

Deserts. *Scottish G. Mag.* 31 (1915): 241–244. **Gregory.**

Deserts. By Prof. J. W. Gregory.

Geological History. *Papers and P.R.S. Tasmania*, 1914 (1915): 32–34. **Rodway.**

Botanic Evidence in favour of Land Connection between Fuegia and Tasmania during the present Floristic Epoch. By Leonard Rodway.

Geomorphology. *Scottish G. Mag.* 31 (1915): 257–260. **Gregory.**

The Relative Distribution of Fiords and Volcanoes. By Prof. J. W. Gregory.

Geophysics. *C.R. A. Sc.* 160 (1915): 695–700. **Boussinesq.**

Sur le problème du refroidissement de la croûte terrestre, considéré à la manière et suivant les idées de Fourier. Par J. Boussinesq.

Geophysics. **Hixon.**

[On physical problems bearing on the elevation of continents and mountain ranges.] By Hiram W. Hixon. [Type-written.] *Illustrations (separate).*

Limnology. **Birge.**

The Heat Budgets of American and European Lakes. By Edward A. Birge. (Repr. *Trans. Wisconsin Acad. Sciences, etc.*, vol. 18, pt. i.) N.P., 1915. Size 9 × 6, pp. 47. *Diagrams.*

Oceanography—Sea-level. **Thompson.**

Fishery Board for Scotland. Scientific Investigations, 1914. No. IV. On mean sea-level and its fluctuations. By Prof. D'Arcy W. Thompson, C.B. Edinburgh, 1915. Size 9½ × 6, pp. 45. *Diagrams. Price* 1*s.*

Sedimentation. *American J. Sc.* **39** (1915): 487–508. **Gregory.**
Formation and Distribution of Fluviatile and Marine Gravels. By H. E. Gregory.

Seismology. *Popular Sc. Monthly* **86** (1915): 446–451. **Grasty.**
The Earthquake Areas of the Earth with special reference to the Recent Italian Earthquake. By J. Sharshall Grasty. *Map.*

Terrestrial Magnetism. *Annual Rep., Smithsonian I.*, 1913 (1914): 195–212. **Bauer.**
The Earth's magnetism. By L. A. Bauer. *Charts and Illustrations.*

Vulcanology. *Annual Rep. Smithsonian I.*, 1913 (1914): 275–305. **Day and Shepherd.**
Water and Volcanic activity. By Arthur L. Day and E. S. Shepherd. *Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Civilisation and Climate. **Huntington.**
Is Civilization determined by Climate? By Ellsworth Huntington. (From *Harper's Mag.*, vol. **130**, 1915, pp. 943–951.) Size 10 × 7.

Commercial—Corundum. **Barlow.**
Canada, Geol. Surv. Mem. 57 (1915): pp. vii., 377 and vii.
Corundum, its occurrence, distribution, exploitation, and uses. By Alfred Ernest Barlow. *Maps and Illustrations.*

Economic—Oilfield. *J.G.* **13** (1915): 185–190. **Rich.**
Notes on the Human Geography of an Oil Field. By J. L. Rich.

Economic—Whales. *Annual Rep. Smithsonian I.*, 1913 (1914): 481–489. **Rabot.**
The whale fisheries of the world. By Charles Rabot. *Sketch-maps and Illustrations.*

History of Cartography. *Ts. K. Nederl. Aardr. Gen.*, 2 S., **32** (1915): 231–250. **Wieder.**
De Globe van Van Langren, A° 1612. By F. C. Wieder. *Illustration.*
The oldest example known of a globe by Van Langren, measuring 52·8 centimetres in diameter, has lately been presented to the Netherlands Geographical Society.

GENERAL.

British Empire—Economic. *J.R.S. Arts* **63** (1915): 613–635. **Phillips.**
The Empire's Resources in Paper-making Materials. By S. Charles Phillips.
See note in the Monthly Record.

British Empire—Surveys.
Colonial Reports—Annual No. 828. The surveys of British Africa, British Honduras, Ceylon, Cyprus, Fiji, Hong Kong, Jamaica, Malay States and Trinidad. Ninth Year, to 31st March, 1914. London, 1915. Size 9½ × 6, pp. 41. *Price* 2½*d.*

Educational. **Haddon.**
Educative geography. A note-book for Teachers. By John L. Haddon. London: Bacon & Co., 1915. Size 7 × 5, pp. 76. *Illustrations and Diagrams. Price* 1*s. net. Presented.*

Educational. **Mackinder.**
Mackinder's Elementary studies in geography. Questions and exercises especially prepared as a companion to Distant Lands (pp. 28); Our Own Island (pp. 24); and Lands beyond the Channel (pp. 28). By E. G. R. Taylor. London: G. Philip & Sons, 1915. Size 7½ × 5½. *Price* 3*d. each. Presented.*

Geography. *B.R.S.G. (Madrid), Rev. G. Col. y Merc.* **12** (1915): 129–142. **Ocaña.**
La Geografía como rama de la enseñanza. Por José Sanchez Ocaña.

Historical—French exploration. **Grandidier.**
Rapport sur les voyages et travaux géographiques exécutés par les explorateurs et savants français depuis 25 ans. (X. Congresso Internazionale di Geografia, Roma, 27 Marzo—3 Aprile 1913.) By G. Grandidier. Rome, 1914. Size 10½ × 7½, pp. 31.

History of Geography. **Vasconcellos.**

Investigações Geograficas. Por Ernesto de Vasconcellos. Lisbon, 1915. Size 8½ × 6½, pp. 23.

Reprints of papers on the Discovery of the Nile Sources, Early Portuguese expeditions to Tibet, Bartholomew Dias's farthest pillar, and Mr. Roosevelt's Rio da Duvida.

History of Geography. *Ts. K. Nederl. Aardr. Gen.*, 2 Ser., **32** (1915): 285–318. **Wieder.**

Nederlandsche historisch-geographische documenten in Spanje. Nos. 5 and 6. By F. C. Wieder. *Sketch-map.*

These sections deal with Lafreri's Atlas (see July number, p. 68) and the World-map of Peter Plancius (*supra*, p. 159).

Near East—War. *G.Z.* **21** (1915): 70–82, 131–147. **Schwöbel.**

Der Türkisch-ägyptische Kriegsschauplatz. Von Dr. Valentin Schwöbel.

Political Geography—Frontiers. *B.R.S.G. (Madrid)* **57** (1915): 129–146. **Alonso.**

Valor geográfico y nacional de las fronteras. By Carlos Garcia Alonso.

Political Geography. *Nineteenth Century and After* **77** (1915): 1119–1137. **Holdich.**

Political Boundaries. By Col. Sir Thomas Holdich.

Year-book. **Keltie.**

The Statesman's Year-book. Statistical and historical annual of the states of the world for the year 1915. Edited by Dr. J. Scott Keltie, assisted by Dr. M. Epstein. 52nd annual publication. London: Macmillan, 1915. Size 7½ × 5, pp. lxxxiv. and 1586. *Maps. Price 10s. 6d. net.*

NEW MAPS.

By E. A. REEVES, Map-Curator, R.G.S.

EUROPE.

Austro-Italian Frontier. **Galli.**

Pio Galli: Il Veneto, le Alpi Carniche e Giulie. Scale 600,000 or 1 inch to 9·5 stat. miles. Size 21 by 28 inches. Milan: A. Vallardi, [1915].

A general map of north-eastern Italy and adjacent parts of Austria that should be useful in following the present military operations. It shows railways, roads, paths, boundaries, and other information. Relief is somewhat roughly indicated by brown shading; water is in blue.

Balkans. **Service Géographique de l'Armée, Paris.**

Balkans 1,000,000ᵉ (1 inch to 15·78 stat. miles). Sheets: Belgrade; Salonique. Size 16 by 22 inches. Paris: Service Géographique de l'Armée. *Price 1.25 fr. each sheet.*

Shows new boundaries.

Europe. **Herbertson.**

The Oxford Wall Maps. Edited by A. J. Herbertson, M.A. The Western War Area: the Seine Basin, Belgium, and the Rhine Lands. Scale 1: 500,000 or 1 inch to 7·89 stat. miles. Size 60 by 60 inches. Oxford: The Clarendon Press, [1915]. *Price, unmounted, 12s. 6d. Presented by the Publishers.*

A carefully drawn and very effective map of the land-relief and river systems of that part of Western Europe extending from the Loire to the mouth of the Rhine, and from south-east England to Lake Constance. Relief is shown on the layer system in white, buff and reddish-brown, darkening in shade with the increase of altitude, until, at the greatest heights, it becomes practically black. Contours are given at 100 metres intervals from 0 to 1200 metres, while the tints change at the 100, 200, 400, 600, 1000, 1200 metres. Depths of water are indicated by tints of blue at intervals of 20 metres. Land below sea-level is shown in green.

With the exception of those of rivers and lakes no names appear on the map, so that there is nothing to obscure the physical features; still it would have been an

advantage if the principal towns had been indicated, even if only by light stamps, as it would have been a great assistance in reading the map. On the right of the map, by some slip, the parallel of 50° is numbered 52°.

Flanders. **Sifton, Praed & Co.**

The British Line in Flanders. Enlarged from the French War Office Map. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Two sheets each 17 by 31 inches. London : Sifton, Praed & Co., 1915. *Presented by the Publishers.*

A black and white enlargement of sheets of the 1 : 80,000 French Depôt de la Guerre map of France, with certain names of places referred to in connection with the war added.

Germany. **Service Géographique de l'Armée, Paris.**

Généralisation de la Carte de l'Allemagne au 300,000e (1 inch to 4·7 stat. miles). Sheets : Amsterdam ; Anvers ; Cologne ; Düsseldorf ; Hambourg ; Kiel ; Leeuwarden ; Oldenbourg ; Osnabrück. Size 15 by 18 inches. Paris : Service Géographique de l'Armée, [1915]. *Presented by the Director of Military Operations.*

These are continuations of the map noticed in the last number of the *Geographical Journal*.

Iceland. **Generalstabens Topografiske Afdeling, Copenhagen.**

Generalstabens Topografiske Kort over Island. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets : 2 S.A., 3 N.A., 3 S.A. Saudlauksdalur ; 10 S.A. Straumnes ; 11 N.A., 11 S.V., 11 S.A. Stigahid ; 12 N.V., 12 N.A., 12 S.V , 12 S.A. Þingeyri ; 13 N.V. Bardaströnd ; 20 S.V., 20 S.A. Horn ; 21 N.V., 21 N.A., 21 S.V., 21 S.A., Drangajökull ; 22 N.V., 22 N.A., 22 S.V., 22 N.V., 22 S.A. Langadalsströnd ; 31 S.V. Ofeigsfjördur ; 32 N.V., 32 N.A., 32 S.V., 32 S.A., Kuvikur. Size 16 by 18 inches. Copenhagen : Generalstabens Topografiske Afdeling, 1915. *Presented by the Chief of the Danish General Staff.*

Turkey. **E. Stanford, Ltd.**

Stanford's War Maps, No. 13. The Seat of War in the Dardanelles and the Bosporus embracing the country from Adrianople to Constantinople. Scale 1 : 383,000 or 1 inch to 6 miles. Size 28 by 32 inches. London : Edward Stanford, Ltd., 1915. *Price, unmounted, 5s.*

Another of these useful war maps which have from time to time been mentioned in the *Geographical Journal*. It includes all that remains of Turkey in Europe, the Dardanelles, Bosporus, and Sea of Marmora, with the adjacent parts of Asia Minor. Railways and roads are shown, as well as a large number of place-names, which, however, do not obscure the map partly owing to the fact that there is no hill-shading. A list of geographical and topographical terms used, with their meaning, is given in the right-hand top corner of the map.

ASIA.

India. **Survey of India.**

Maps published by the Survey of India during the quarter ending March 31, 1915. Miscellaneous maps : Aden Protectorate, scale 1 inch to 4 miles. India and adjacent countries, scale 1 : 1,000,000, sheet 65 and part of 66. Degree sheets, scale 1 inch to 4 miles : Bengal and Assam, sheets 78 G (Provisional Issue). Berar and Central Provinces, sheet 55 L. Bihar and Orissa and Madras, sheet 65 M (Provisional Issue). Central India and United Provinces, sheet 63 H (Provisional Issue). Central Provinces, sheet 65 A (Provisional Issue). Madras, sheets 65 L and 64 B (Provisional Issues). United Provinces, sheets 54 I and 63 A (Provisional Issues). Standard Maps, scale 1 inch to 1 mile, Assam, sheet 83–B 8. Bihar and Orissa, sheets (preliminary edition with village boundaries) : 64–O 11, 72–C 11, 72–P 8, 73–A 15, 73–I 13, 73–M 1, 73–M 5. Bihar and Orissa and Central Provinces, sheets (preliminary edition with village boundaries) 64–K 16, 64–O 3 and 4, 64–O 7 ; Bihar and Orissa and United Provinces (preliminary edition with village boundaries), sheets 63–O 7 and 8, 63–P 5, 72–C 10 ; Central Provinces, sheet 55–O 4 ; Kashmir and Jammu, sheets : 43–J 2, 43–J 6, 43–J 14, 43–O 6 ; Punjab, sheets : 43–L 16, 44–I 9, 44–I 10, 44–I 11, 44–I 14, 44–M 1, 44–M 2, 44–M 3, 44–M 4, 44–M 7, 44–N 7, 44–O 13, 53–B 3, 53–B 7, 53–B 9, 53–B 10, 53–B 11 ; Punjab and United Provinces, sheet : 53–H 12 ; United Provinces, sheets : 54–M 10, 54–M 12, 54–M 16, 63–A 2, 63–A 3, 63–A 4, 63–A 5, 63–A 10, 63–A 10, 63–A 12, 63–A 14, 63–E 5, 63–E 10, 63–E 14, 63–E 15. Calcutta : Map Record and Issue Office, Survey of India, 1915. *Presented by the Surveyor-General of India.*

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 17, Cypress, Saskatchewan, 5th edit., November 1, 1914; 67, Maple Creek, Saskatchewan, 5th edit., November 1, 1914; 70, Moose Mountain, Saskatchewan, 6th edit., February 1, 1915; 118, Rush Lake, Saskatchewan, 7th edit., September 1, 1914; 219, Humboldt, Saskatchewan, 6th edit., October 1, 1914. Size 18 by 32 inches. Ottawa : Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

Canada—Alberta. **Dept. of the Interior, Ottawa.**

Southern Alberta. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Map showing disposition of lands. Prepared in the Railway Lands Branch, F. C. C. Lynch, Superintendent. Corrected to January 1, 1915. Fifteenth Edition. 38 by 34 inches. Ottawa : Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

Canada—British Columbia. **Surveyor-General's Dept., B.C.**

Pre-emptor's maps. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 3 F, Chilcotin; 3 H, Tête Jaune; 3 J, North Thompson. Size 40 by 26 inches. Victoria : Geographic Branch, Surveyor-General's Department, 1915. *Presented by the Surveyor-General's Department, Victoria, B.C.*

Canada—Manitoba. **Dept. of the Interior, Ottawa.**

Manitoba. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Map showing disposition of Lands. Prepared in the Railway Lands Branch, F. C. C. Lynch, Superintendent. Corrected to January 1, 1915. Size 38 by 29 inches. Ottawa : Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

WORLD.

World. **Stieler.**

Stieler's Hand-Atlas 100 Karten in Kupferstich mit 162 Nebenkarten. Herausgegeben von Justus Perthes' Geographischen Anstalt in Gotha. Neuute, von Grund aus Neubearbeitete und Neugestochene Auflage. Zehnter berichtigter Abdruck. Gotha : Justus Perthes, 1914.

No new maps have been added in this edition, and the numbering and arrangement remain as before. The revision seems to have been carefully carried out on the whole up to the date given in the corner of each map, and corrections have been made to boundaries and in a few instances to the topographical features. In the case of the Balkan Peninsula, No. 50, the corrections to the boundaries have been coloured in by hand, and as the old lines have not been erased both new and old boundaries are given. As with previous editions, there is a good alphabetical index to place-names at the end of the atlas.

World. **Taylor.**

Philips' Synthetic Maps, consisting of eight transparencies and two coloured foundation maps with suggestions for class use. By E. G. R. Taylor, B.Sc. Series 1, The World; 2, The British Isles; 3, Europe; 4, Asia; 5, Africa; 6, North America; 7, South America; 8, Australasia. Size 8 by 10 inches. London : George Philip & Son, Ltd., [1915]. *Price 6d. net. each set. Presented by the Publishers.*

Eight sets of maps in separate covers, dealing with (1) The World, (2) British Isles, (3) Europe, (4) Asia, (5) Africa, (6) North America, (7) South America, and (8) Australasia. Each set consists first of all of two so-called foundation maps printed on thin cardboard, one giving, on the tinted layer system, the relief of land, and the other by various colours the density of population. After the "foundation" maps follows a series of eight outline maps on tracing paper on the same scale, and so arranged that they can be superimposed upon the latter, the features of which are clearly seen through the tracing paper. With the exception of the World, where there is some modification of the arrangement, these transparencies show in as bold a style as the scale will allow : (1) Political Divisions, (2) Communications, (3) Minerals, (4) Climate—Winter, (5) Climate—Summer, (6) Natural Vegetation, (7) Temperature

for July, (8) Temperature for January. Each tracing map can be studied separately, but the principal object in view in the series is to teach the natural relation and association of geographical facts, which are clearly brought out by superimposing the proper tracing upon the foundation maps, and upon each other; hence they are called "synthetic" or building-up maps. For older scholars the scheme has a good deal to commend it, if properly carried out, under the supervision of a good teacher. It would be better if the maps could all have been on a somewhat larger scale.

CHARTS.

Norway. **Norges Geografiske Opmaaling.**

Kystkart 80, Harstad og Sjövegan til Dyroy. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Size 28 by 40 inches. Christiania: Norges Sjökartverk, 1915. *Presented by the Norwegian Geographical Institute.*

TIDAL DIAGRAM.

Tidal Diagram. **Fulton.**

Captain D. Fulton's Tidal Diagram. Size 14 by 14 inches. London: J. D. Potter, 1915. *Price 4s. with boxwood rule. Presented by the Publishers.*

A diagram, accompanied by a ruler, for obtaining approximately the height of the tide above or below mean tide-level at any time. On a card 13 inches square are two sets of curves intersecting each other; one of these indicates "Time from High or Low Water," and the other "Duration of Rise or Fall." Across the curves run a number of horizontal lines, and the position where one of these cuts the intersection point of the curves for any time from high or low water, as shown by a ruler pivoted on a central point, gives the height above or below mean tide-level, by reading off a scale at the side. Full instructions for use are given on the cover.

PHOTOGRAPHS.

Ontario. **Wilkie.**

Fourteen photographs of the Algonquin Provincial Park, Ontario, taken by Captain C. C. Wilkie, 1915. *Presented by Captain C. C. Wilkie.*

As will be judged by the very complete titles, this is an interesting set of photographs. They are of two sizes, 3 by 4 and 3 by 5½ inches.

(1) The end of the first day's journey—paddling and carrying; (2) Our camp on Cedar Lake: house in the distance is a Lumber Company's supply depôt; (3) Cedar Lake (14 miles long), at the north of the Algonquin Provincial Park; (4) Dinner-time at the river-drivers' camp, Perley Lake: jam of logs in the background; (5) Cache Lake at the Rangers' headquarters (moonlight photograph): park covers 2500 square miles of virgin country, teeming with game; (6) Held up by a heavy gale on a small island in White Trout Lake (only 6 miles long, but quite a sea can get up); (7) 70-feet fall near the headwaters of the Petewawa River: on the right is the lumberman's timber slide; (8) River drivers on the Upper Petewawa River, about to break a log jam; (9) Landing a 5-lb. speckled trout at the headwaters of the Petewawa River; (10) An "alligator" boat, used by the lumber companies: on water it is propelled by paddle-wheels (side wheels), or hauled by a winding-in drum: on land it draws itself along over corduroy roadways by anchoring a cable and winding in: here towing a huge boom of logs; (11) A trout stream in early April, 2000 feet above sea-level: 5 feet of snow in the woods; (12) A typical beaver dam: early spring; (13) Homeward bound: with the required particulars as to forest fires, areas burned, and timber cut; (14) Back to civilization: Algonquin Park headquarters, new hotel and railway in the south portion of Algonquin Park; (15) Headquarters, Algonquin Park in May; (16) Source Lake, Geetz; (17) Park ranger bringing in a poisoned timber wolf, frozen stiff.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

Sketch Maps of

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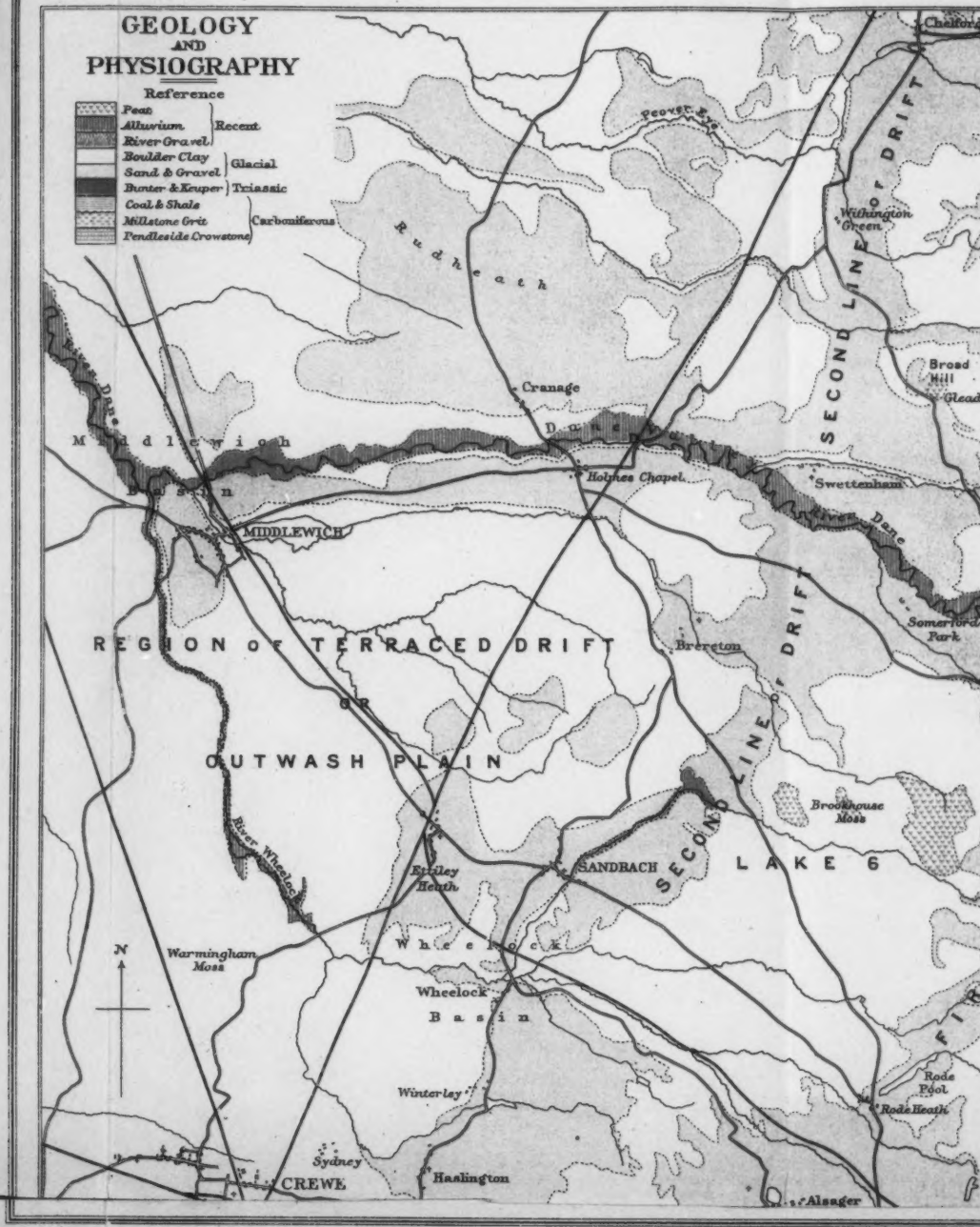

Maps of the

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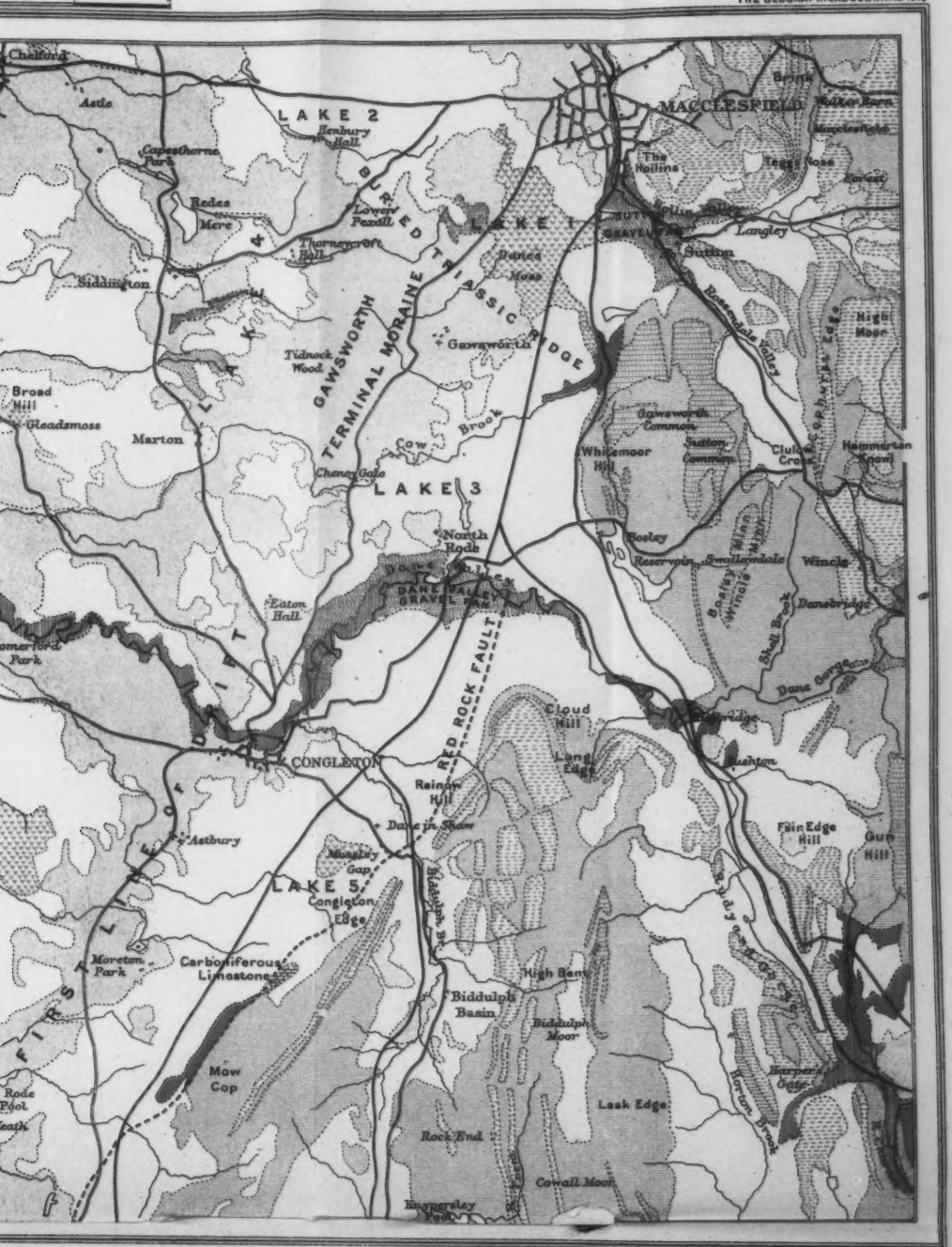

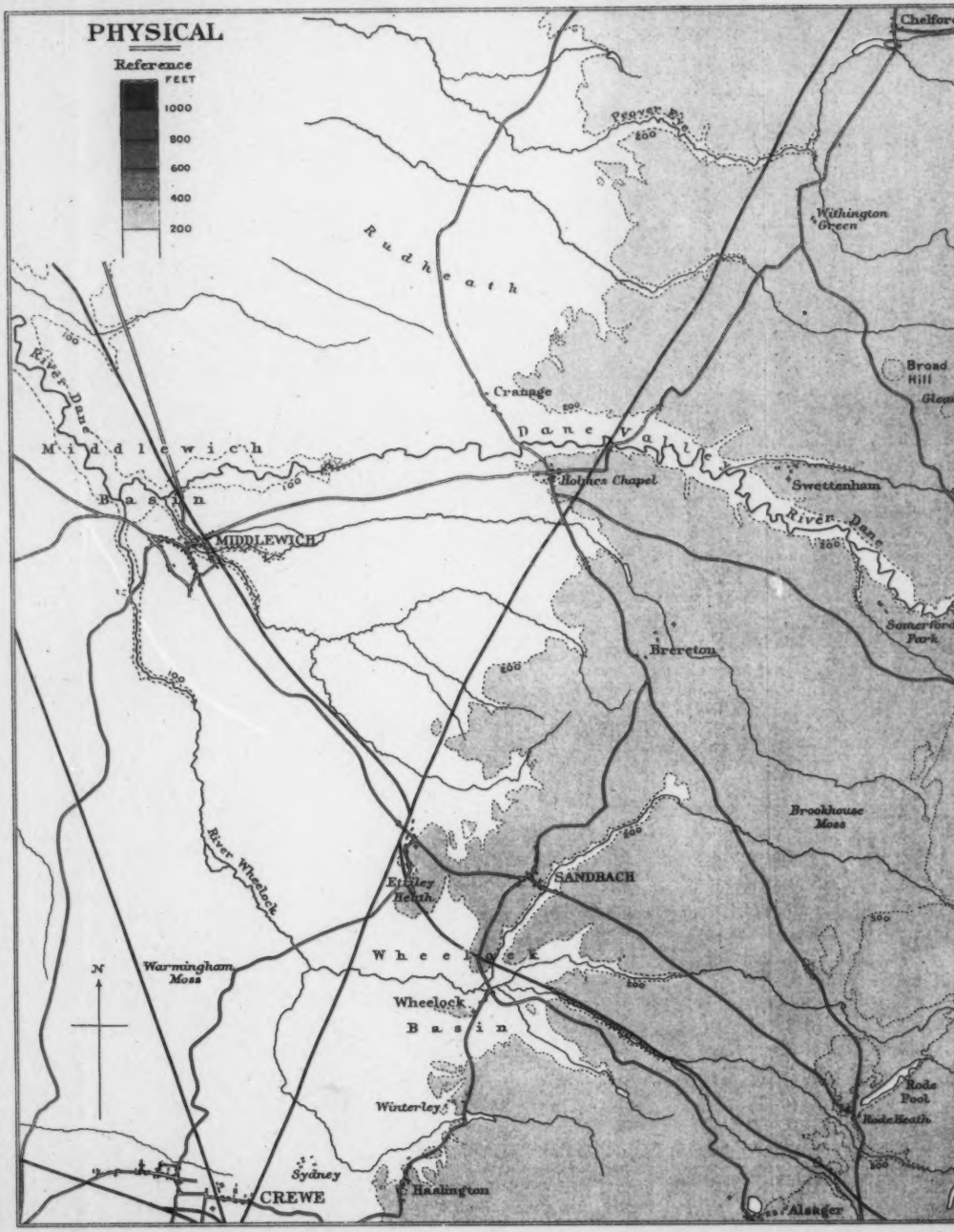

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